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USAELRDL Technical Report 2343

LOGARITHMIC PERIODIC ANTENNA AS -1089(XE-1)/ML

Peter Bodnar

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UNITED STATES ARMY

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FORT MONMOUTH, N.J.

U. S. ARMY ELECTRONICS RESEARCH AND DEVELOPMENT LABORATORY

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LOGARITHMIC PERIODIC ANTENNA AS-1089(XE-1)/ML

Peter Bodnar

DA Task No. 3E54-01-001-02

Abstract

The electrical and mechanical characteristics of Antenna AS-1089(XE-1)/ML, a small, lightweight, broadband antenna of the broadly directional, pyramidal log-periodic type, are ~~described and~~ discussed. The antenna covers the frequency range of 200 to 800 mc, and has moderate gain and a medium power-handling capability. Data on impedance, gain, pattern characteristics, and power-handling capability have been obtained experimentally and are presented in this report. Although designed specifically for transmitting operations in the frequency range of 275 to 600 mc, the antenna can efficiently transmit over the 200- to 800-mc band, and can receive over the 200- to 1200-mc range.

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CONTENTS

FIGURES

CONTENTS (CONTD)

LOGARITHMIC PERIODIC ANTENNA AS-1089(XE-1)/ML

INTRODUCTION

Antenna AS-1089(XE-1)/ML has been developed at the U. S. Army Electronics Research and Development Laboratory to provide an antenna for use with receiving and transmitting equipments in the ultra-high frequency range. The unit was designed to meet a requirement for a lightweight, broadband, broadly directional antenna capable of handling moderate power. It was to have the desirable electrical and physical characteristics of the trapezoidal-tooth, logarithmically periodic type of structure. The antenna is required for use with countermeasures electronic equipments for the transmission and reception of vertically, horizontally, and ±45-degree polarized signals. Although designed specifically for transmitting operations in the frequency range of 275 to 600 megacycles, the antenna can efficiently transmit over the 200- to 800-mc band and can receive over the 200- to 1200-mc range.

This report describes the mechanical and electrical characteristics of the AS-1089(XE-1)/ML, and discusses the results of an evaluation of the antenna to determine its compliance with the established requirements.

DESIGN REQUIREMENTS

The antenna design was based on the following requirements:

(1)	Frequency range	275-600 mc
(2)	Impedance	50 ohms input
(3)	Voltage standing wave ratio	$<$2:1
(4)	Gain	8 db
(5)	Loss (including VSWR)	1 db
(6)	Power-handling capability	400 watts peak (duty factor of 1/2)
(7)	Size	Minimum

DESCRIPTION

<u>Mechanical</u>

The antenna is a trapezoidal-tooth, log-periodic, pyramid-shaped structure (see Figures 1 and 2). Two sides of the pyramid consist of printed-circuit antenna elements imbedded in fiberglas. The fiberglas sides are connected by supporting arms to a nylon collar that can slide up and down the central boom of the antenna. The sliding collar folds and unfolds the antenna with an action similar to that of a bellows. A tapered-line cable balun (shown in Figures 3 and 4) is housed within the central boom of the antenna. A small, watertight compartment near the apex of the pyramid provides weather protection to the antenna feed point and balun terminals. The compartment has a removable plate that permits inspection and repair in the event of malfunction.

The entire antenna weighs five pounds. In the open position, its dimensions are 26 inches by 18.5 inches at the base of the pyramid; in the collapsed position, the base of the pyramid measures 26 inches by 4.75 inches. In either position, the distance from the apex to the end of the boom is 25 inches.

Mechanical strength and durability were provided by the use of such nonmetallic materials as fiberglas, nylon, and teflon. The antenna elements, supporting arms, and central boom are made of fiberglas, and the hinges and knuckles throughout the unit are made of either nylon or teflon. In addition, the printed-circuit antenna elements are coated with an epoxy mixture to prevent corrosion. The weight of the antenna and its wind resistance were decreased by the removal of large rectangular sections of fiberglas from between most of the antenna elements (see Figures 1 and 2).

Electrical

A logarithmically periodic configuration was selected for this antenna because of its promising advantages in view of the design requirements. Trapezoidal-tooth, pyramid-shaped, logarithmically periodic antenna configurations are characterized by moderate and constant gain over large frequency ranges with minimum impedance variations, low side- and back-lobe levels, and small beam tilt.

The AS-1089(XE-1)/ML was designed to provide an average beamwidth of 80 degrees in both the horizontal and vertical planes over the required frequency range of 275 to 600 mc, with a maximum back-lobe level of -10 db. This design was achieved by use of a periodicity ratio of 0.85 for the element spacing, an element-included angle of 71 degrees, and an angle of 45 degrees between the two element groups.[1--4]

TESTS AND EVALUATION

A series of tests was performed on the antenna to determine its electrical characteristics. The procedure used was similar to that described in Reference 6.

The following test equipments were used:

Hewlett Packard: Signal Generator Models 608A and 512A
Slotted Line Model 805A
VSWR Meter Model 415A
VHF Bridge Model 805A
VHF Detector Model 417A

Scientific Atlanta Inc.: Antenna Pattern Recorder Model 122B
Control and Indicator Univ. Model 142-2
Wide Range Receiving System Series 402
Range Tower with extension section

The results were evaluated and are summarized below.

Voltage Standing Wave Ratio (VSWR)

When referred to a 50-ohm line, the voltage standing wave ratio of the antenna is 2.46 to 1 or less, as shown in Figure 5. The average VSWR across the frequency range of 275 to 600 mc is 1.51 to 1.

The tapered line balun (Figures 3 and 4) has handled 400 watts of continuous RF power with no deterioration of its electrical performance. Its average VSWR over the 200-to 1200-mc range is 1.57 to 1.

Pattern Characteristics

The polar charts in Figures 6 through 30 show the variation in the amplitude or antenna response as a function of azimuth and elevation angle for several typical frequencies. The pattern characteristics, such as beamwidth, beam tilt, and front-to-back ratios, are reasonably uniform throughout the frequency range. The pattern response is smooth at all frequencies, with no significant side lobes or spurious nulls within the main lobe.

1. Half-Power Beamwidth. Measured data show that, within the 275-to 600-mc frequency range, the half-power beamwidths average 92 degrees in the vertical plane and 72.5 degrees in the horizontal plane. In either plane, the widest beamwidth measured was 112 degrees, and the narrowest was 64 degrees. Figure 31 gives this information in further detail.

2. Front-to-Back Ratio. The measured radiation patterns have an average front-to-back ratio of 11.16 db in the vertical plane and 11.27 db in the horizontal plane. The highest value of the front-to-back ratio is 20 db, and the lowest is 7.2 db. These data can be seen in Figure 32.

3. Beam Tilt. The radiation patterns show that the beam tilt average is 4.15 degrees in the vertical plane and 2.65 degrees in the horizontal plane. The most pronounced beam tilt in either plane is 7.5 degrees.

Gain

The AS-1089(XE-1)/ML has an average gain of 7.7 db over an isotropic source and 5.73 db over a half-wave dipole antenna. These figures are computed gains based on the beamwidth averages obtained in both the vertical and horizontal planes and the resulting average directivity of the measured patterns. Comparative gain measurements with respect to a half-wavelength dipole were not made; however, based upon these calculated gain figures and previous evaluations of log periodic antennas, the difference between the computed gain and the measured gain can be assumed to be less than 1 db.

Power-Handling Capability

The power-handling capability of the AS-1089(XE-1)/ML exceeds 400 watts of CW power with no degradation of performance. In a test at 369.5 mc, 415 watts of power was applied to the antenna for a period of ten minutes. The reflected power at this frequency was 13 watts. At 480 mc, with the same type of power applied for the same length of time, the reflected power was only 2 watts, indicating an extremely low VSWR with a very high propagation efficiency factor. Increasing the applied power to 450 watts did not affect the performance of the antenna. The VSWR of the antenna at 369.5 mc is 1.7 to 1; at 480 mc, 1.2 to 1.

APPLICATIONS

Although the AS-1089(XE-1)/ML was designed as a transmitting antenna for the frequency range of 275 to 600 mc, it can be used for receiving operations over the frequency range of from 200 mc to approximately 1200 mc. Within this wider band the VSWR is less than 2.5 to 1. In the 825- to 1230-mc region, however, the propagation patterns show a slight deterioration; the main lobes are not completely symmetrical, and the rear lobes are more pronounced. At a few of the frequencies measured, the beam tilt becomes significant, particularly in the vertical plane where a maximum of 18.5 degrees was encountered at 1150 mc.

CONCLUSIONS

Mechanically, Antenna AS-1089(XE-1)/ML has met the specified design requirements. It is a lightweight, rugged unit featuring a small silhouette with low wind resistance. When not in use, the antenna folds into a small, compact unit. The entire antenna weighs less than five pounds.

The polarization adjustment of the AS-1089(XE-1)/ML provides horizontal, vertical, or ±45-degree operation, depending upon the tactical requirements. To change the polarization, the operator simply adjusts a thumbscrew and rotates the antenna on its axis to the desired mode of operation.

The antenna has also met the specified electrical design requirements with the following characteristics:

1. The effective frequency range for transmitting purposes is 200 to 800 mc, which exceeds the original design requirement (275 to 600 mc) at both ends of the frequency range. For receiving operations the antenna can be used over the extended range of 200 mc to approximately 1200 mc.

2. The antenna can capably handle 400 watts of CW power within the frequency range of 200 to 800 mc. This power-handling capability exceeds the original requirement.

3. The average VSWR over this frequency range is under 2 to 1, which meets the requirements (see Figure 5).

4. The average gain is 7.7 db, which closely approaches the original requirement of 8 db.

RECOMMENDATIONS

Although Antenna AS-1089(XE-1)/ML is satisfactory for the purpose intended, the following changes are recommended for improved performance in other applications:

1. The overall structure could be improved significantly by elimination of the folding feature. The advantage of collapsibility is questionable since the antenna is small and compact even when expanded. Without this feature, the antenna could be fabricated more easily and less expensively, and its performance would be more efficient both electrically and mechanically.

2. The present power-handling capability of 400 watts of RF power could be increased considerably by (a) replacing the present balun, which is made of RG-9/U coaxial cable, with a newer type made of RG-17/U cable;[5] and (b) using sheet metal for the antenna elements near the apex of the pyramid instead of the thin copper printed circuits now used. With the new type balun, which was developed for higher power equipment, and the sheet metal antenna elements, which can withstand high temperature, the antenna should be capable of handling approximately 1000 watts of RF power.

ACKNOWLEDGEMENTS

Acknowledgement is made to Mr. Anthony R. Siracusano, Engineering and Drafting Branch, Engineering Design Division, for the mechanical design of the antenna; and to Mr. Joseph G. Garvey, Machine Shop, Electronic Warfare Division, for the fabrication of the antenna.

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2. V. H. Rumsey, "Frequency Independent Antennas," 1957 IRE National Convention Record, Part I, pp 114-118.

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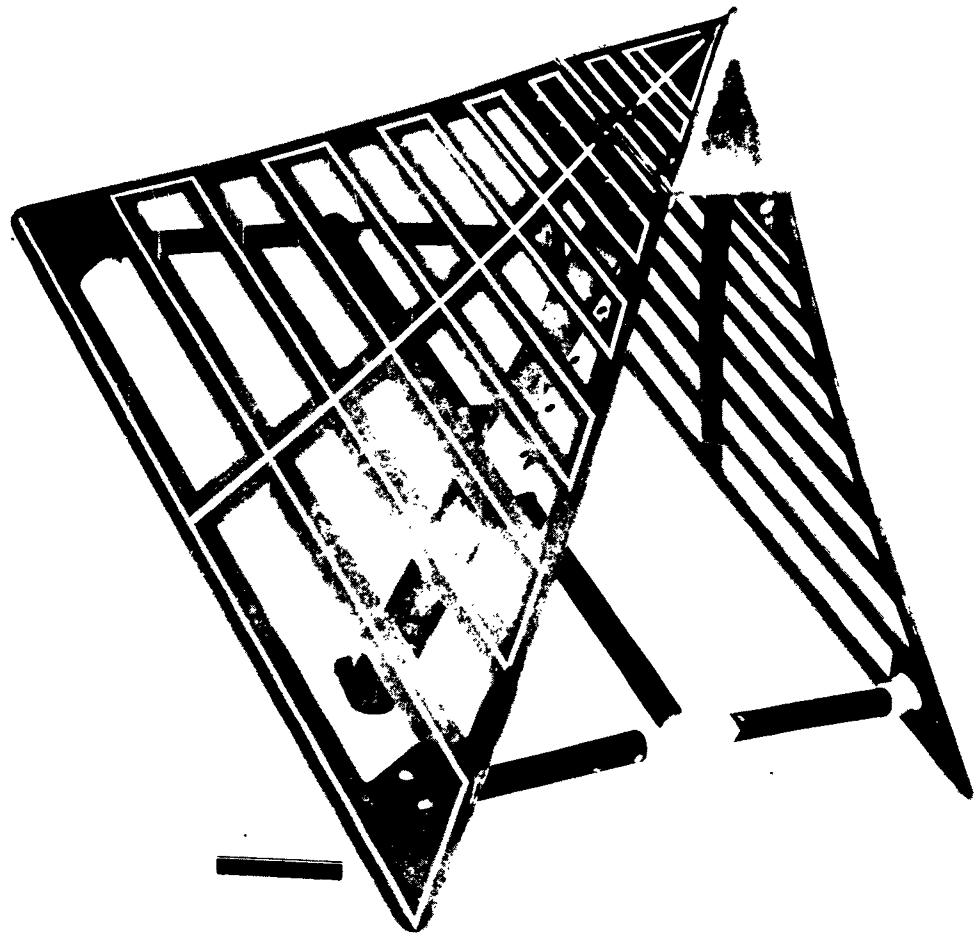
4. R. H. DuHamel and F. R. Ore, "Logarithmically Periodic Antenna Designs," Collins Radio Company, CTR-198, 31 March 1958.

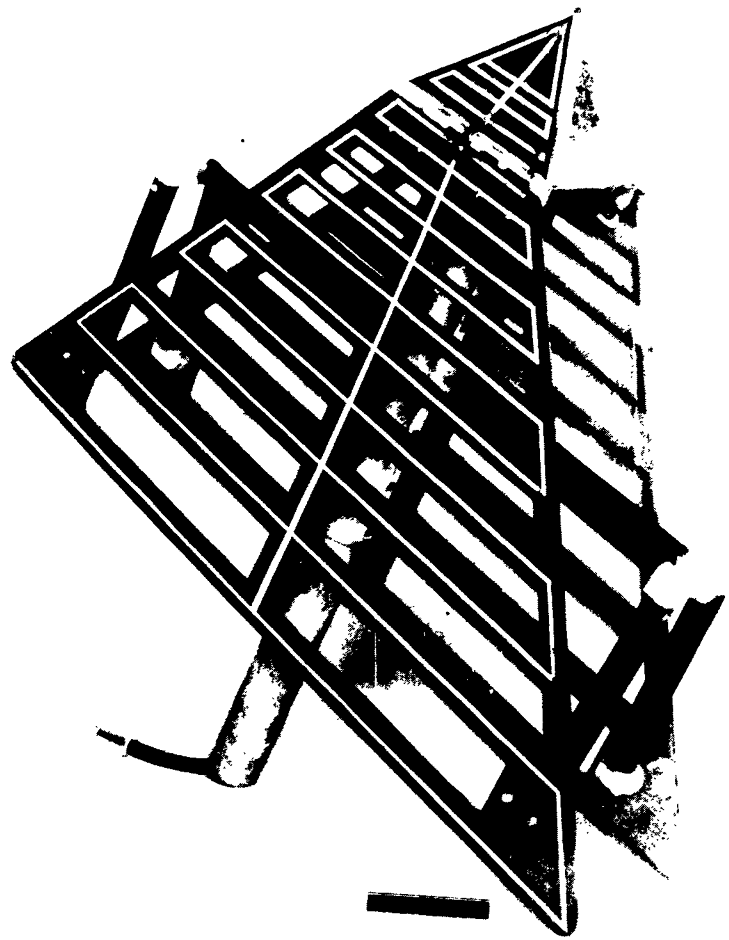
5. J. W. Duncan and V. P. Minerva, "100:1 Bandwidth Balun Transformer," Proceedings of the IRE, pp 156-164, February 1960.

6. J. D. Kraus, Antennas, McGraw-Hill Inc. 1950, pp 444-487.



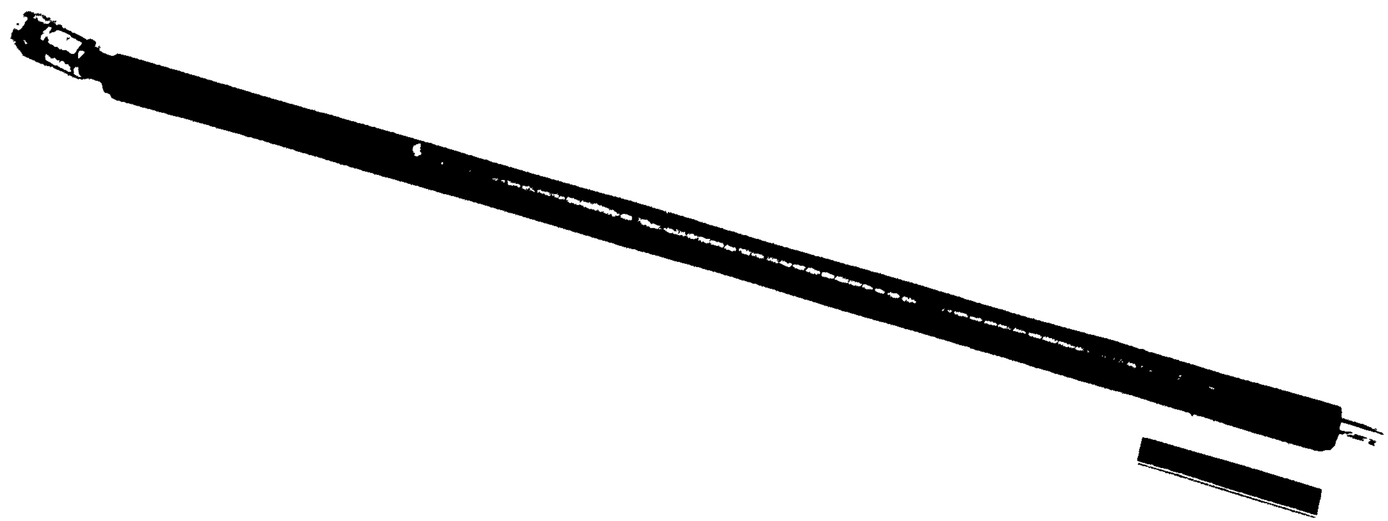
LOG PERIODIC ANTENNA AS-1089( )/ML IN OPEN POSITION

FIGURE 1



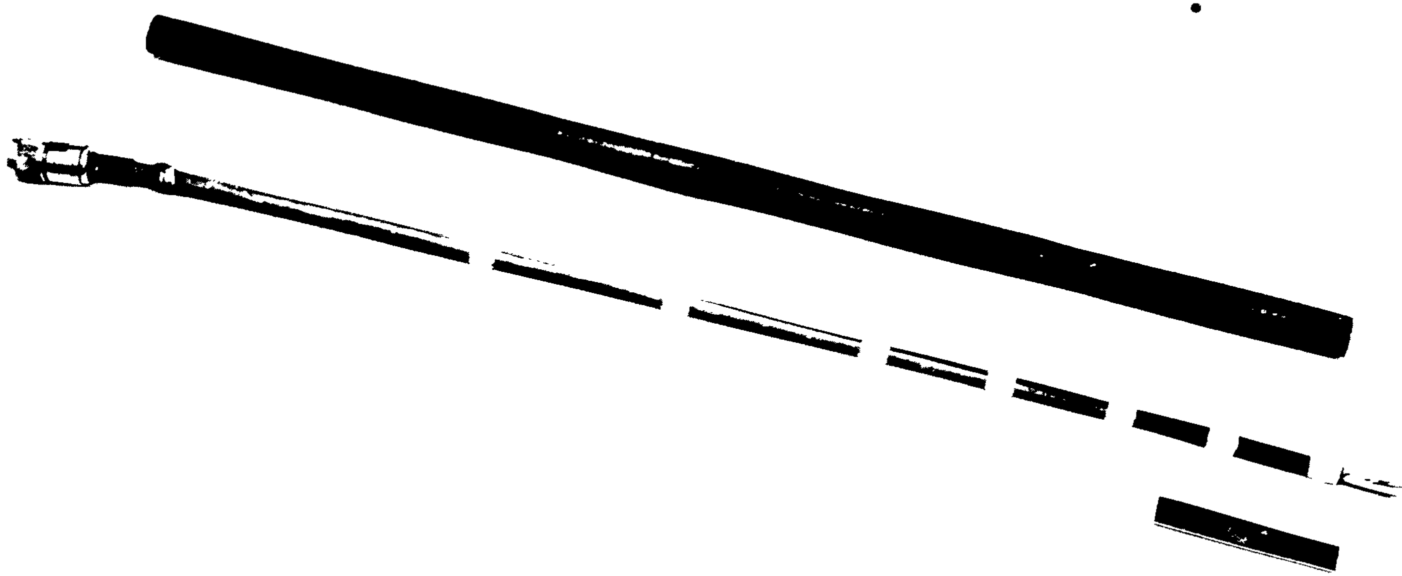
LOG PERIODIC ANTENNA AS-1089( )/ML IN CLOSED POSITION

FIGURE 2



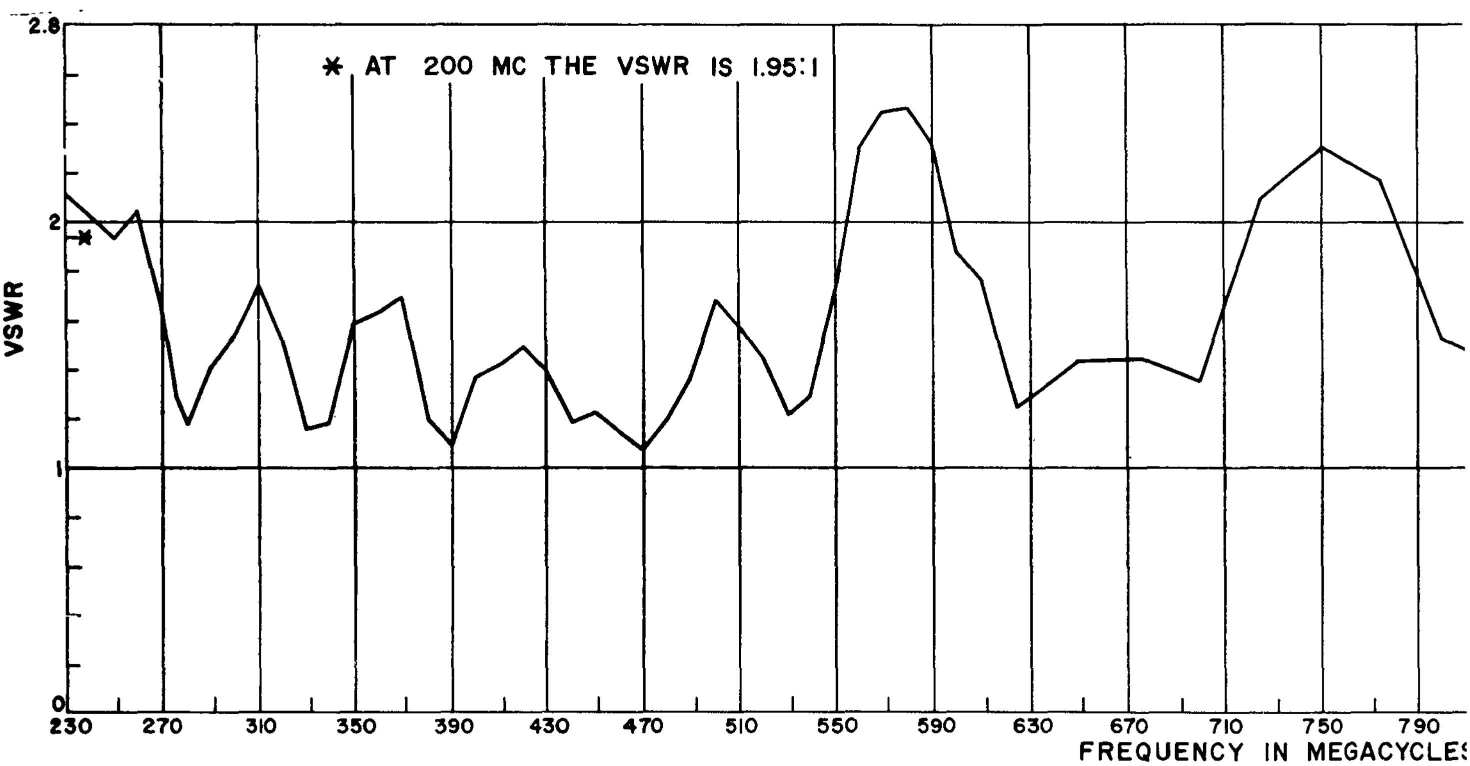
TAPERED LINE CABLE BALUN, FULLY ENCASED

FIGURE 3



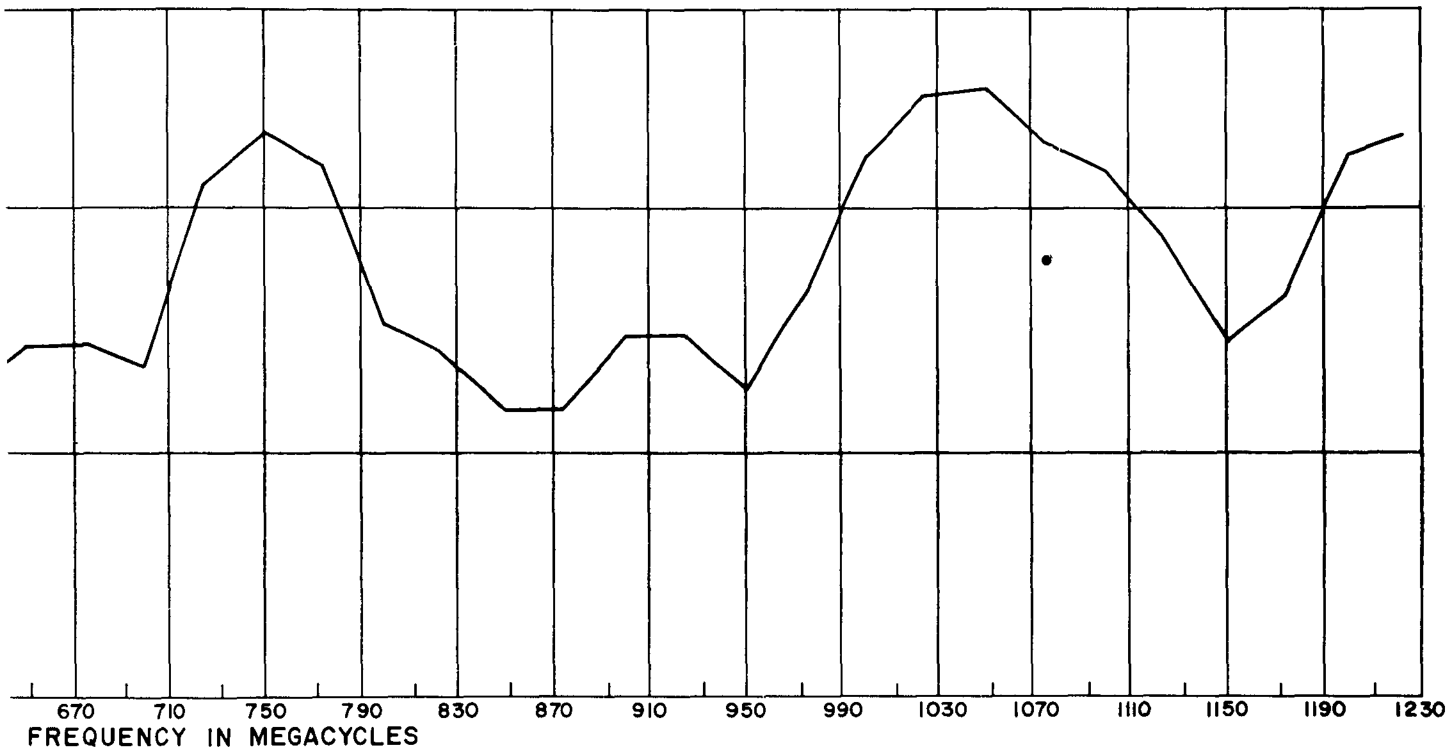
TAPERED LINE CABLE BALUN, PRIOR TO BEING ENCASED

FIGURE 4



VSWR OF LOG PERIODIC ANTENNA

FIG. 5



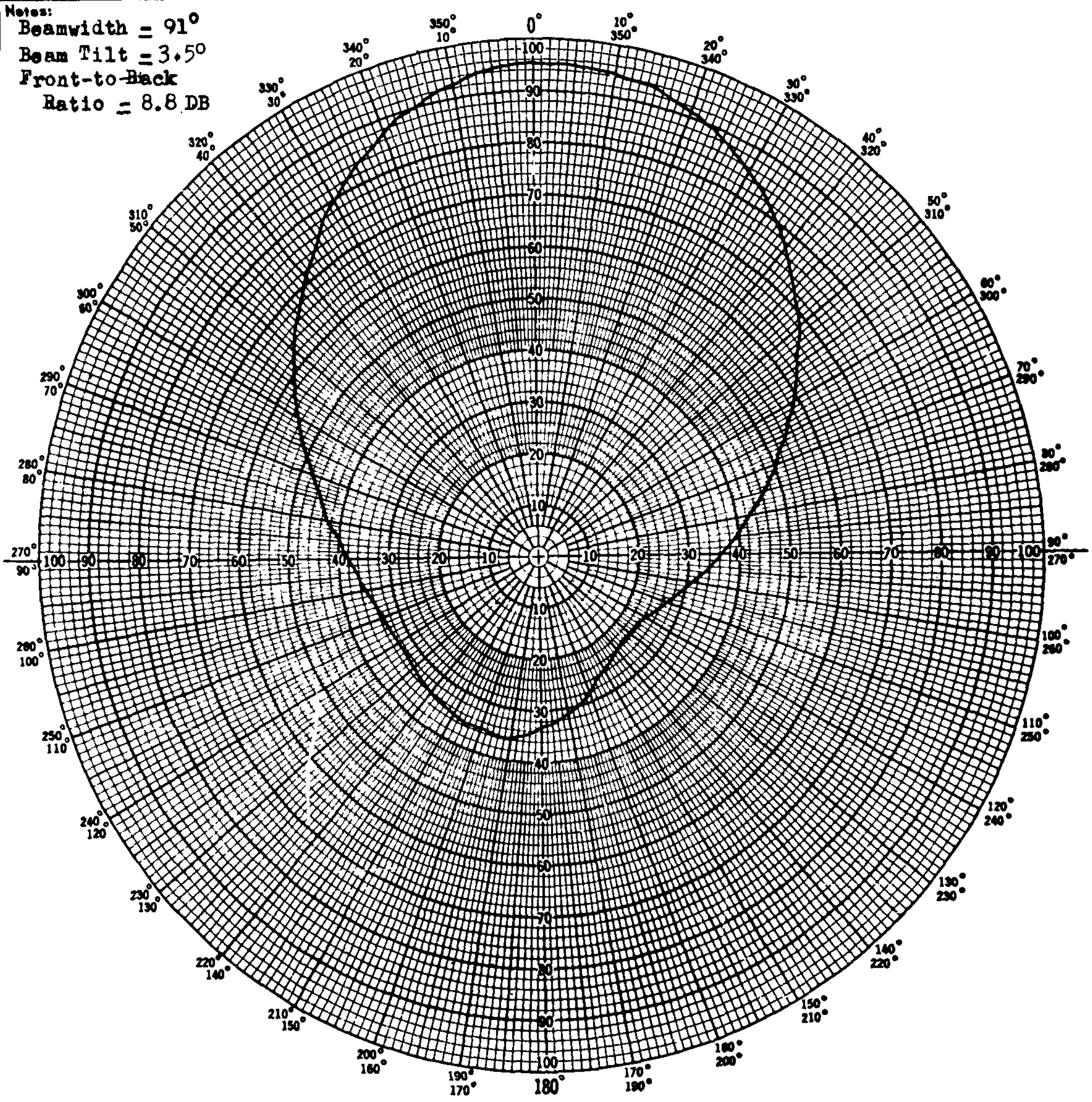
PERIODIC ANTENNA AS-1089 (XE-1)/ML

FIG. 5

FINAL MODEL AS-1089 (XE-1)/ML

FREQUENCY: 225 Mc	POLARIZATION TRANSMITTER		POLARIZATION RECEIVER		ROTATION		PATTERN	
SCALE: POWER [ ] VOLTAGE [X]	VERTICAL	[X]	VERTICAL	[X]	AZIMUTH	[X]	E-PLANE	[ ]
PERSONNEL: Peter Bodnar	HORIZONTAL	[ ]	HORIZONTAL	[ ]	ELEVATION	[ ]	H-PLANE	[X]
							AXIAL RATIO	[ ]

Notes:
Beamwidth = 91°
Beam Tilt = 3.5°
Front-to-Back
Ratio = 8.8 DB



PATTERN NO. 1

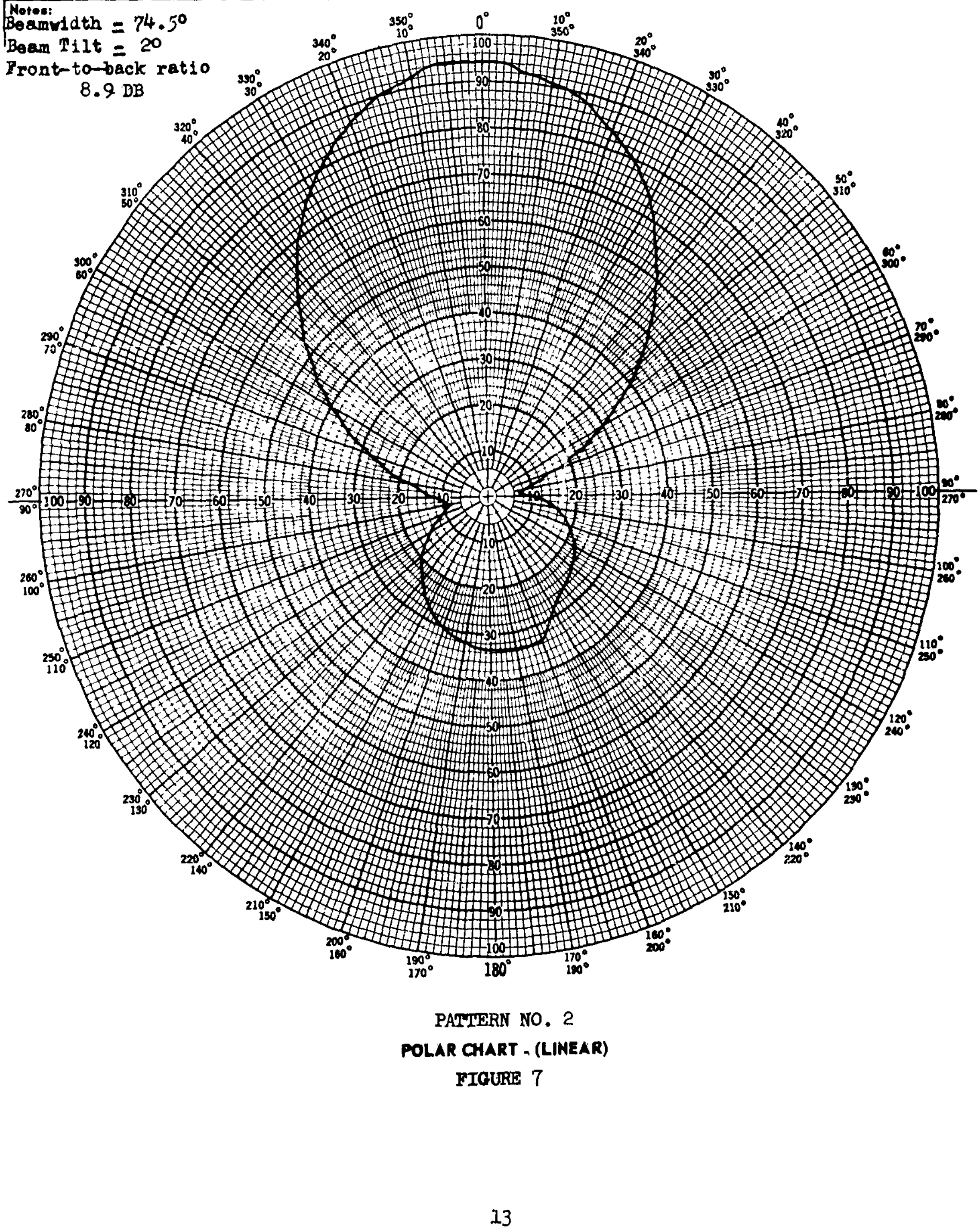
POLAR CHART - (LINEAR)

FIGURE 6

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 225 Mc		POLARIZATION					PATTERN	
	TRANSMITTER		RECEIVER		ROTATION			
SCALE: POWER ☐ VOLTAGE ☒	VERTICAL	☐	VERTICAL	☐	AZIMUTH	☒	E-PLANE	☒
PERSONNEL: Peter Bodnar	HORIZONTAL	☒	HORIZONTAL	☒	ELEVATION	☐	H-PLANE	☐
							AXIAL RATIO	☐

Notes:
Beamwidth = 74.5°
Beam Tilt = 2°
Front-to-back ratio
8.9 DB



PATTERN NO. 2

POLAR CHART - (LINEAR)

FIGURE 7

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 250 Mc

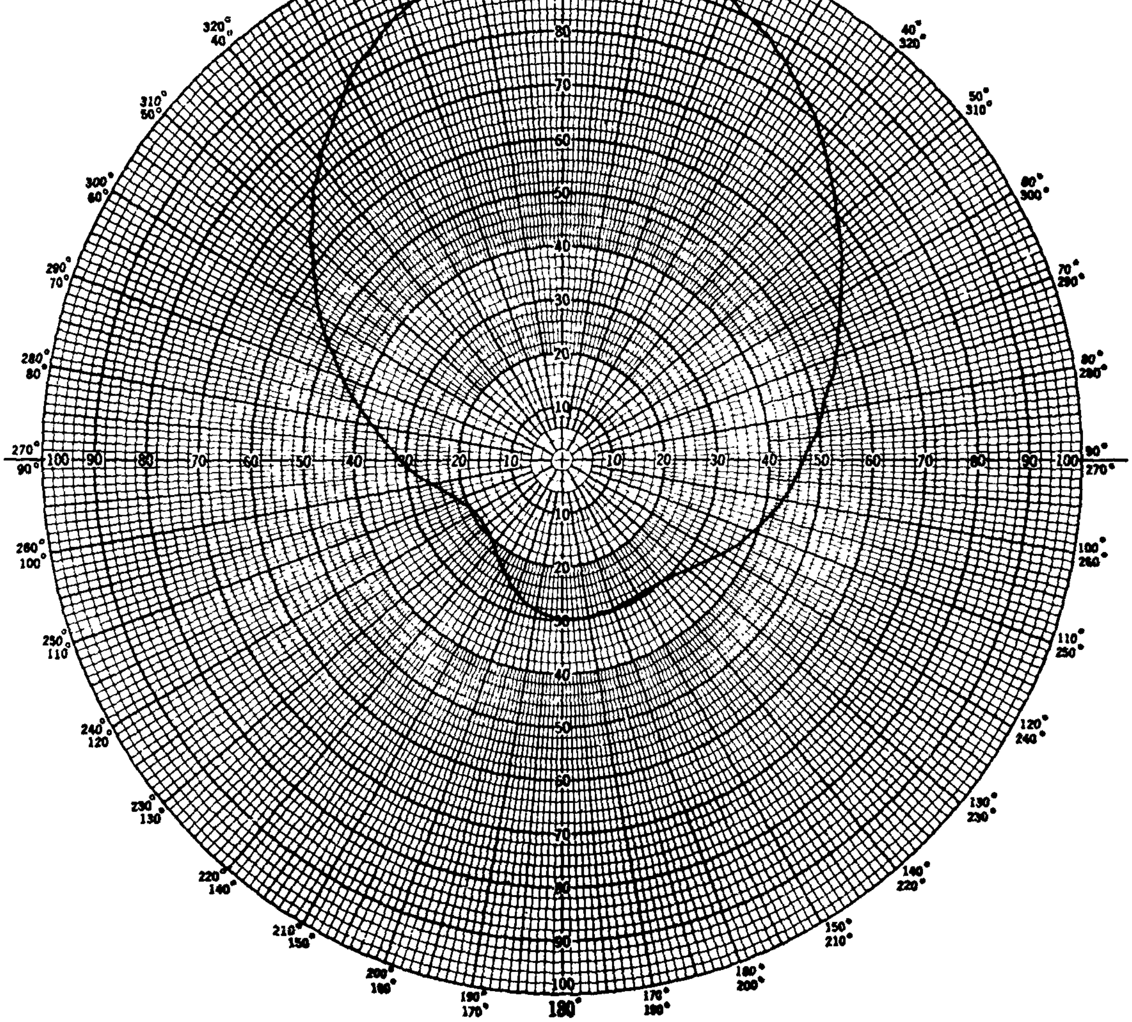
SCALE: POWER [ ] VOLTAGE [X]

PERSONNEL: Peter Bodnar

POLARIZATION

TRANSMITTER		RECEIVER		ROTATION		PATTERN	
VERTICAL	[X]	VERTICAL	[X]	AZIMUTH	[X]	E-PLANE	[ ]
HORIZONTAL	[ ]	HORIZONTAL	[ ]	ELEVATION	[ ]	H-PLANE	[X]
						AXIAL RATIO	[ ]

Notes:
Beamwidth = 95°
Beam Tilt = 3.5°
Front-to-back ratio
10.1 DB



PATTERN NO. 3

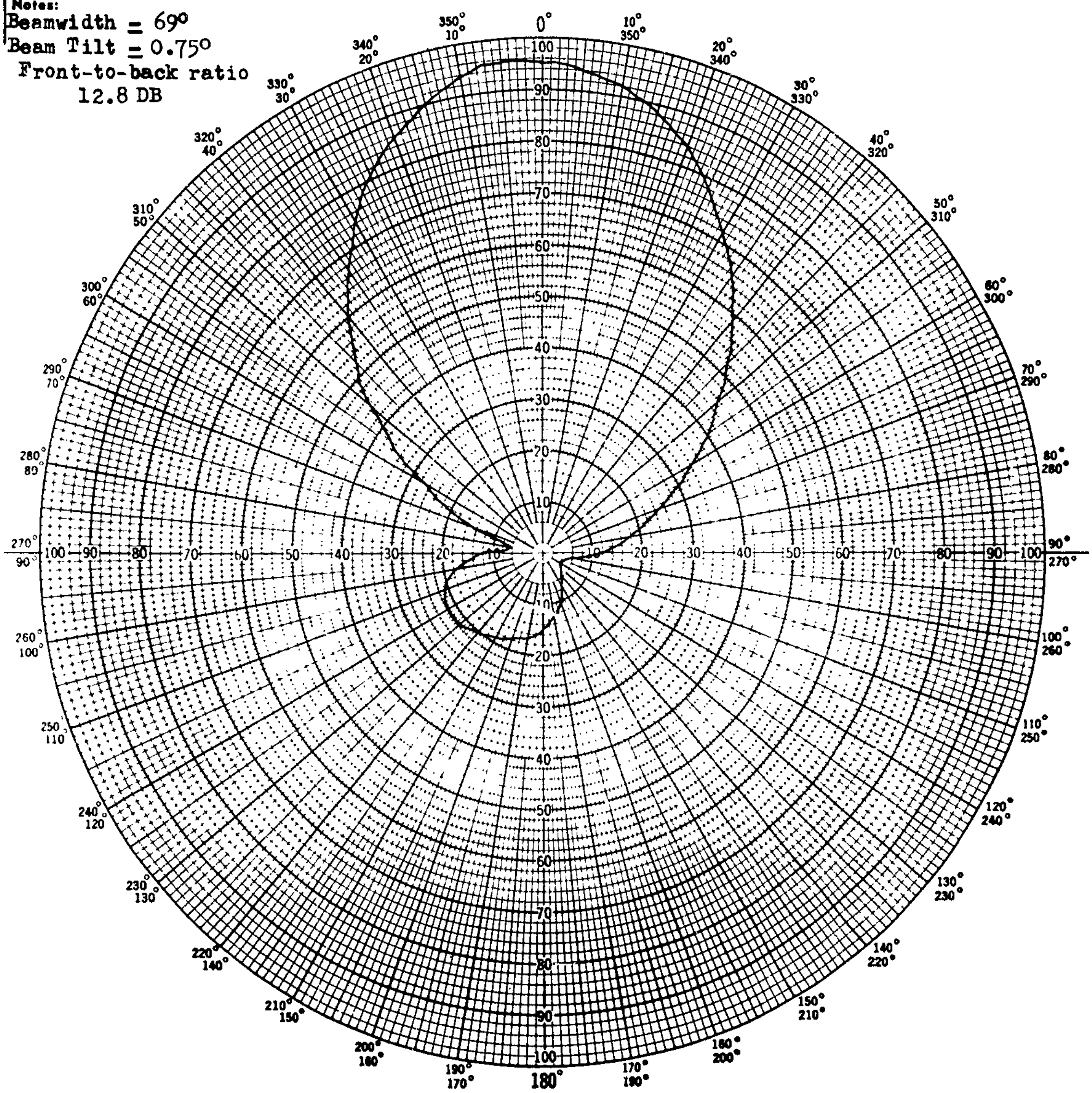
POLAR CHART - (LINEAR)

FIGURE 8

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 250 Mc	**TRANSMITTER**	**POLARIZATION RECEIVER**	**ROTATION**	**PATTERN**
SCALE: POWER ☐ VOLTAGE ☒	VERTICAL ☐	VERTICAL ☐	AZIMUTH ☒	E-PLANE ☒
PERSONNEL: Peter Bodnar	HORIZONTAL ☒	HORIZONTAL ☒	ELEVATION ☐	H-PLANE ☐
				AXIAL RATIO ☐

Notes:
Beamwidth = 69°
Beam Tilt = 0.75°
Front-to-back ratio
12.8 DB



PATTERN NO. 4

POLAR CHART - (LINEAR)

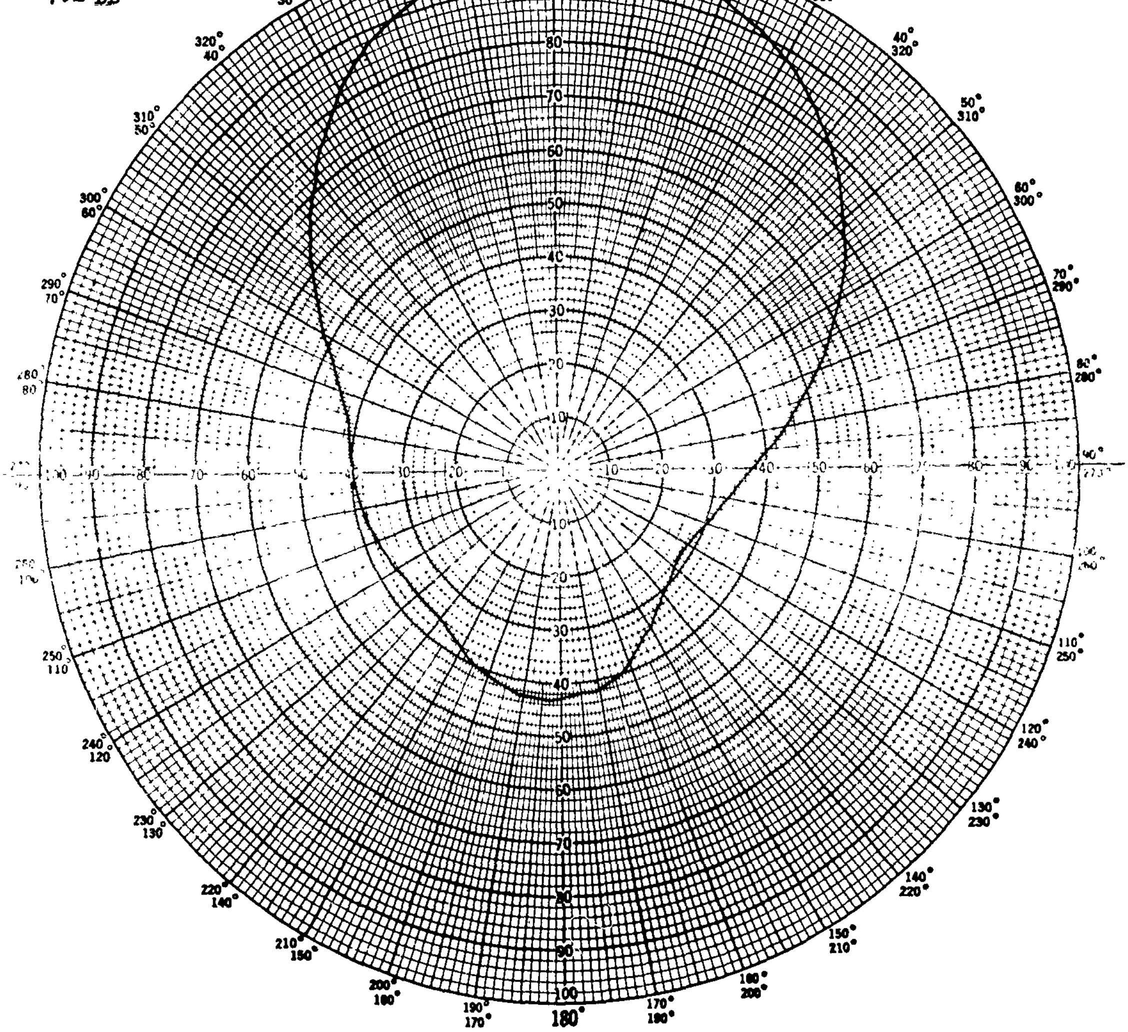
FIGURE 9

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 300 Mc.	TRANSMITTER	RECEIVER	ROTATION	PATTERN
SCALE: POWER [ ] VOLTAGE [X]	VERTICAL [XX]	VERTICAL [X]	AZIMUTH [ ]	E-PLANE [ ]
PERSONNEL: Peter Bodnar	HORIZONTAL [ ]	HORIZONTAL [ ]	ELEVATION [ ]	H-PLANE [XX]
				AXIAL RATIO [ ]

POLARIZATION: TRANSMITTER / RECEIVER

Notes:
Beamwidth = 97°
Beam Tilt = 4.5°
Front-to-back ratio= 7.2 DB



PATTERN NO. 5

POLAR CHART - (LINEAR)

FIGURE 10

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 300 Mc

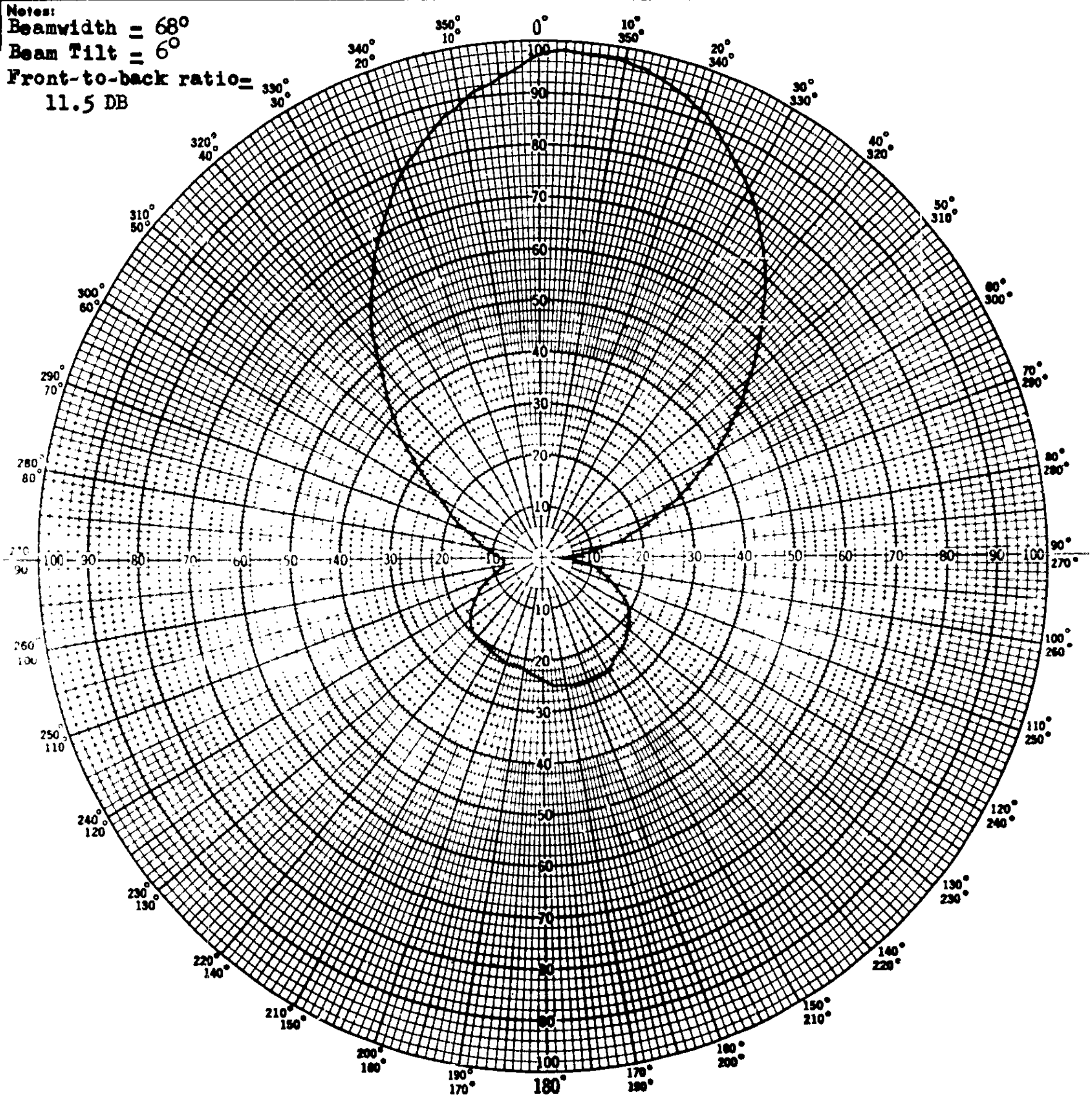
SCALE: POWER [ ] VOLTAGE [X]

PERSONNEL: Peter Bodnar

POLARIZATION

TRANSMITTER		RECEIVER		ROTATION		PATTERN	
VERTICAL	[ ]	VERTICAL	[ ]	AZIMUTH	[X]	E-PLANE	[X]
HORIZONTAL	[X]	HORIZONTAL	[X]	ELEVATION	[ ]	H-PLANE	[ ]
						AXIAL RATIO	[ ]

Notes:
Beamwidth = 68°
Beam Tilt = 6°
Front-to-back ratio = 11.5 DB



PATTERN NO. 6

POLAR CHART - (LINEAR)

FIGURE 11

FINAL MODEL AS-1089(XE-1)/ML

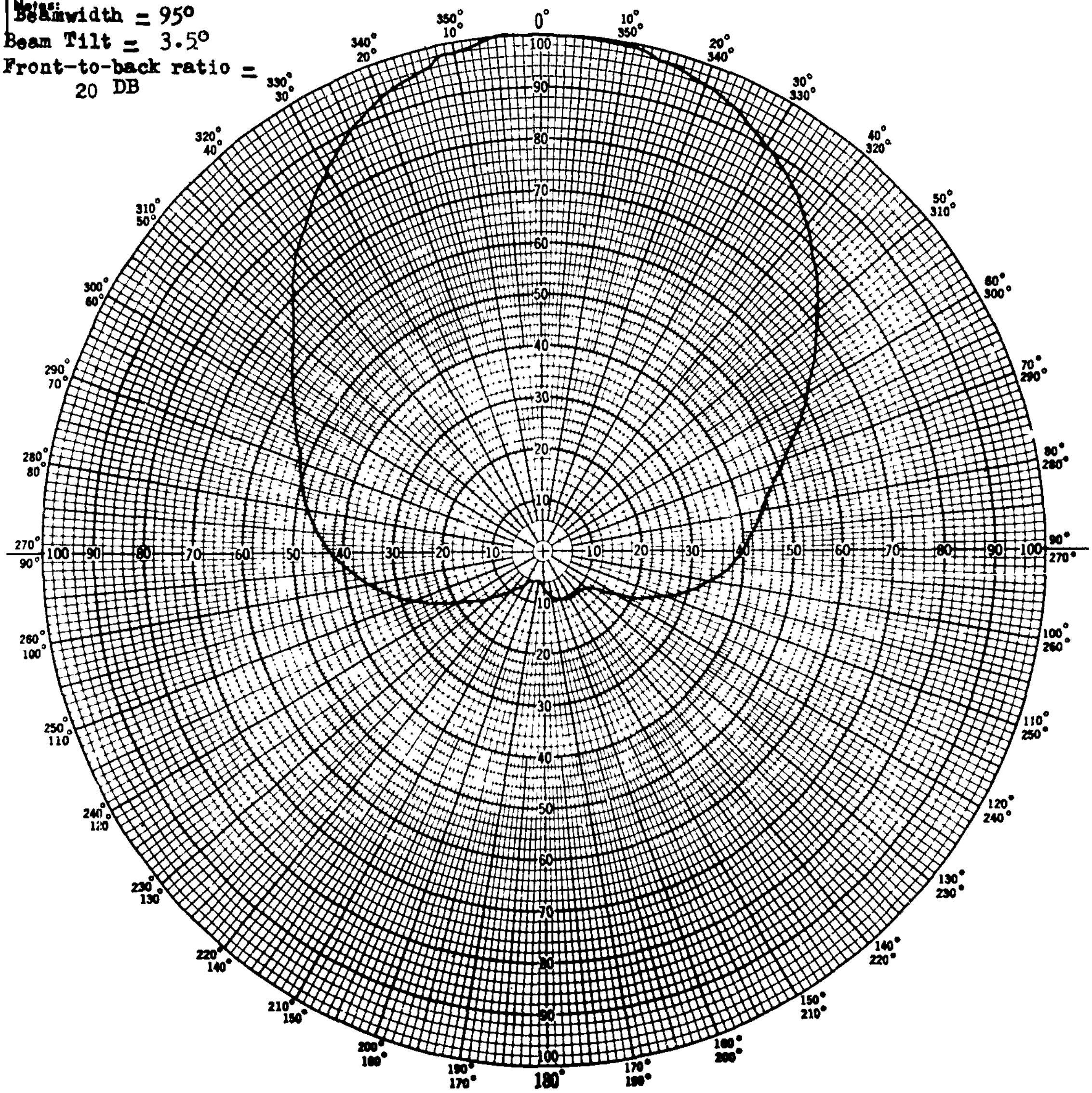
FREQUENCY: 350 Mc
SCALE: POWER ☐ VOLTAGE ☒
PERSONNEL: Peter Bodnar

POLARIZATION
TRANSMITTER: VERTICAL ☒ HORIZONTAL ☐
RECEIVER: VERTICAL ☒ HORIZONTAL ☐

ROTATION: AZIMUTH ☒ ELEVATION ☐

PATTERN: E-PLANE ☐ H-PLANE ☒ AXIAL RATIO ☐

Notes:
Beamwidth = 95°
Beam Tilt = 3.5°
Front-to-back ratio = 20 DB



PATTERN NO. 7
POLAR CHART - (LINEAR)
FIGURE 12

FINAL MODEL AS-1089(XE-1)/ML

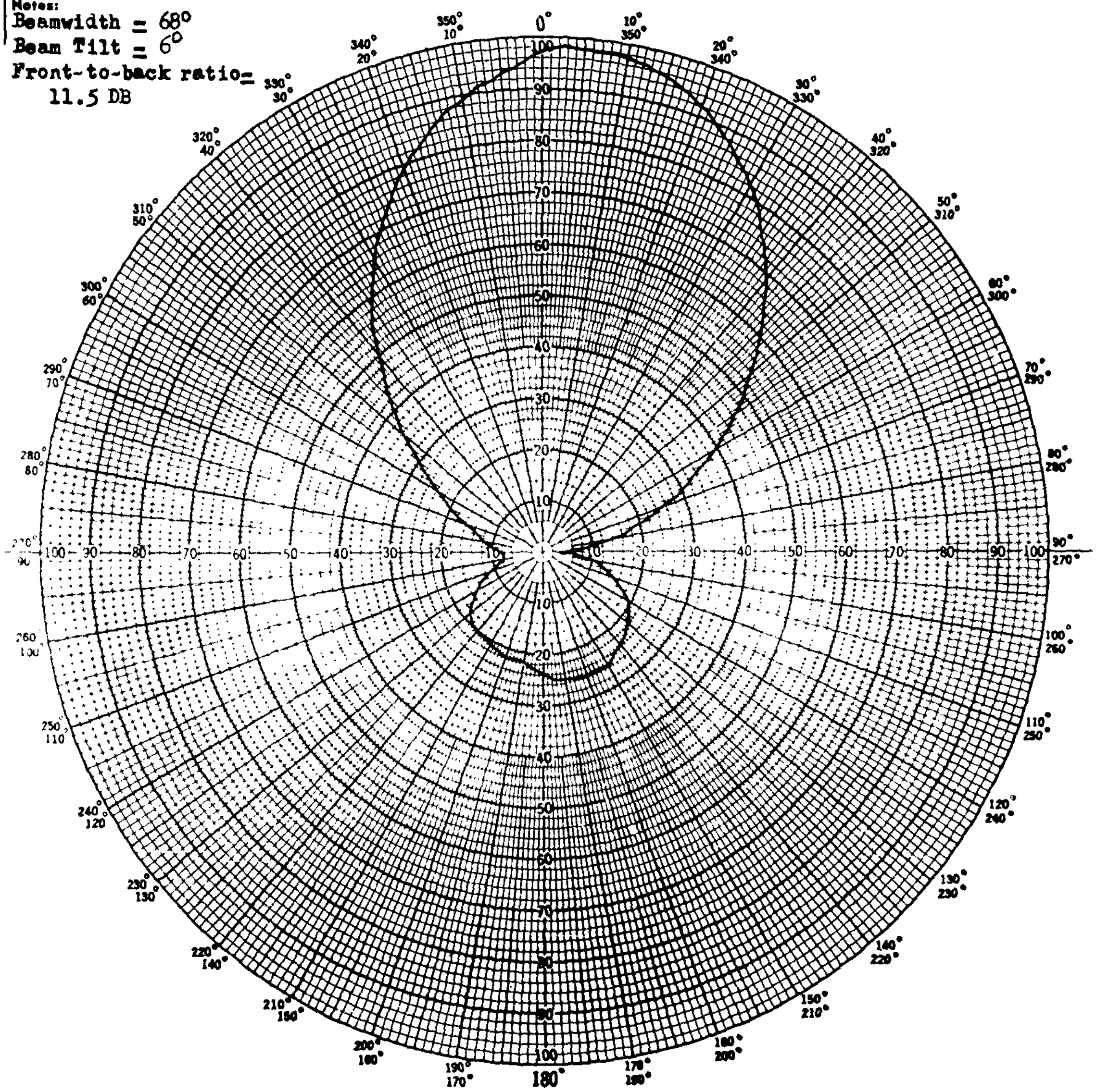
FREQUENCY: 300 Mc

SCALE: POWER [ ] VOLTAGE [X]

PERSONNEL: Peter Bodnar

POLARIZATION							
TRANSMITTER		RECEIVER		ROTATION		PATTERN	
VERTICAL	[ ]	VERTICAL	[ ]	AZIMUTH	[X]	E-PLANE	[X]
HORIZONTAL	[X]	HORIZONTAL	[X]	ELEVATION	[ ]	H-PLANE	[ ]
						AXIAL RATIO	[ ]

Notes:
Beamwidth = 68°
Beam Tilt = 6°
Front-to-back ratio = 11.5 DB



PATTERN NO. 6

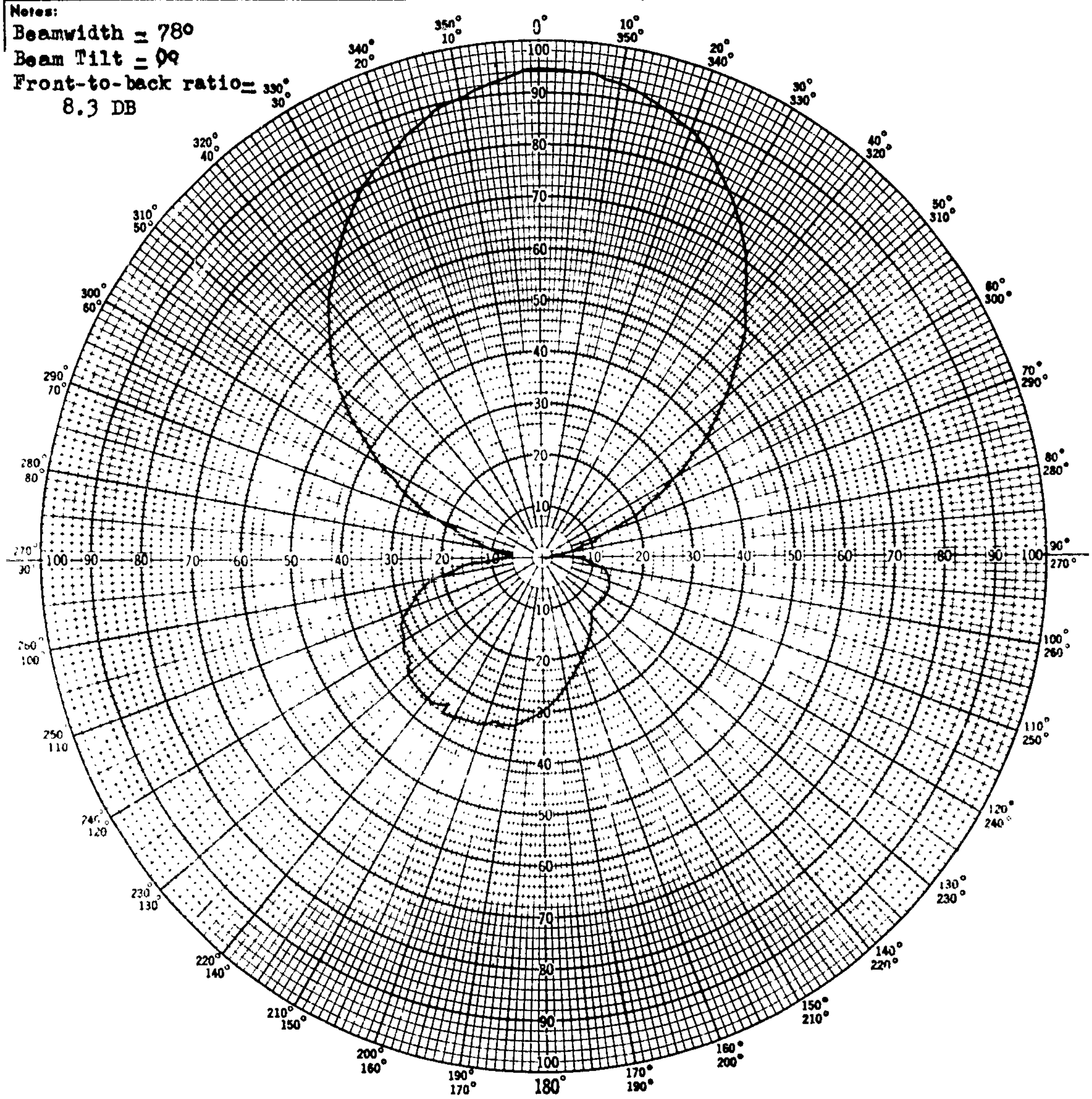
POLAR CHART - (LINEAR)

FIGURE 11

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 350 Mc	**POLARIZATION** TRANSMITTER	RECEIVER	ROTATION	PATTERN
SCALE: POWER [ ] VOLTAGE [X]	VERTICAL [ ]	VERTICAL [ ]	AZIMUTH [X]	E-PLANE [X]
PERSONNEL: Peter Bodnar	HORIZONTAL [X]	HORIZONTAL [X]	ELEVATION [ ]	H-PLANE [ ]
				AXIAL RATIO [ ]

Notes:
Beamwidth = 78°
Beam Tilt = 0°
Front-to-back ratio = 8.3 DB

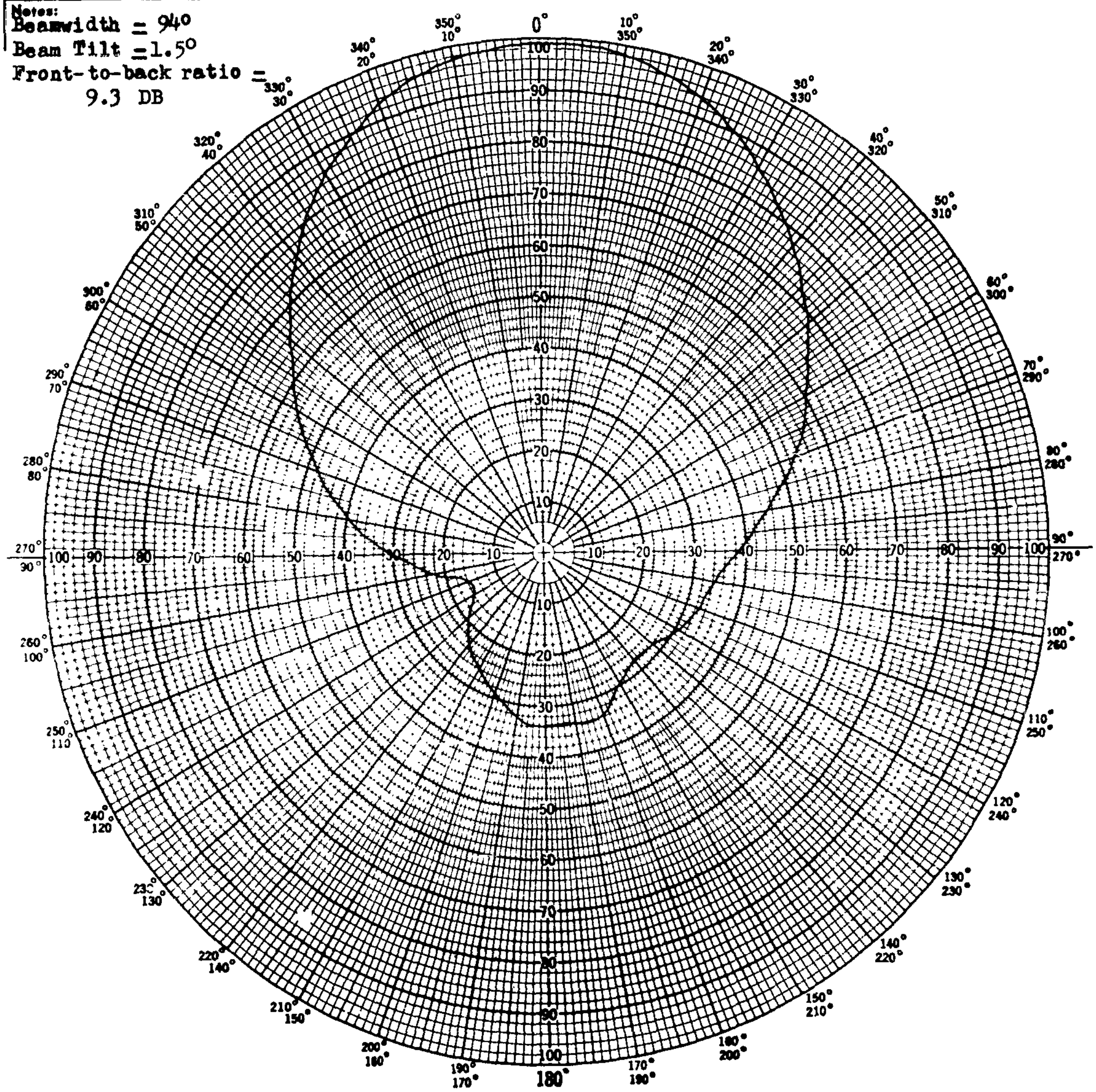


PATTERN NO. 8
POLAR CHART - (LINEAR)
FIGURE 13

FINAL MODEL AS-1089(XE-1)/ML

	POLARIZATION			
FREQUENCY: 400 Mc.	TRANSMITTER	RECEIVER	ROTATION	PATTERN
SCALE: POWER [ ] VOLTAGE [X]	VERTICAL [X]	VERTICAL [X]	AZIMUTH [X]	E-PLANE [ ]
PERSONNEL: Peter Bodnar	HORIZONTAL [ ]	HORIZONTAL [ ]	ELEVATION [ ]	H-PLANE [X]
				AXIAL RATIO [ ]

Notes:
Beamwidth = 94°
Beam Tilt = 1.5°
Front-to-back ratio = 9.3 DB



PATTERN NO. 9

POLAR CHART - (LINEAR)

FIGURE 14

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 400 Mc

SCALE: POWER [ ] VOLTAGE [X]

PERSONNEL: Peter Bodnar

POLARIZATION

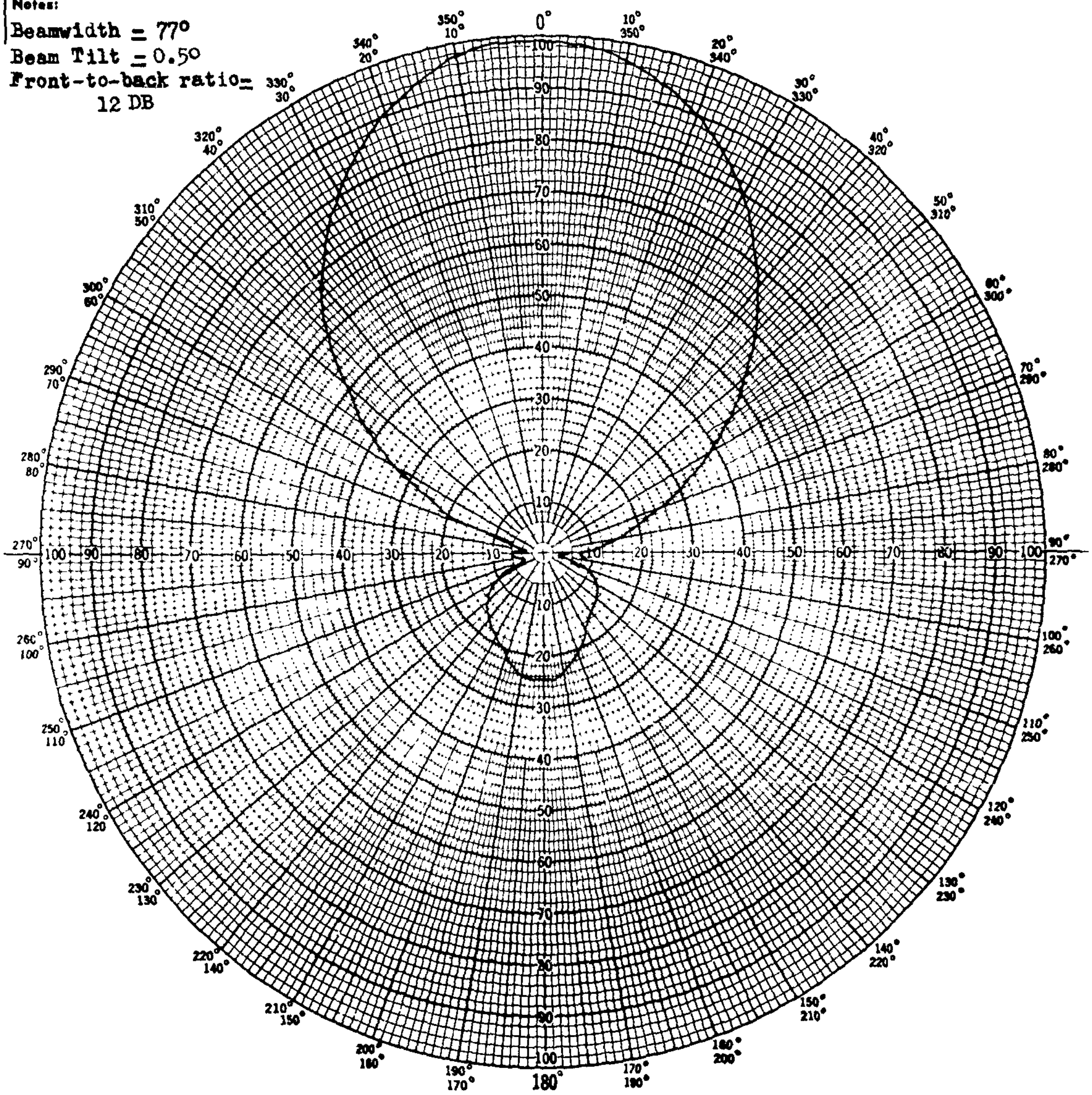
TRANSMITTER		RECEIVER		ROTATION		PATTERN	
VERTICAL	[ ]	VERTICAL	[ ]	AZIMUTH	[X]	E-PLANE	[X]
HORIZONTAL	[X]	HORIZONTAL	[X]	ELEVATION	[ ]	H-PLANE	[ ]
						AXIAL RATIO	[ ]

Notes:

Beamwidth = 77°

Beam Tilt = 0.5°

Front-to-back ratio = 12 DB



PATTERN NO. 10

POLAR CHART - (LINEAR)

FIGURE 15

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 450 Mc

SCALE: POWER ☐ VOLTAGE ☒

PERSONNEL: Peter Bodnar

POLARIZATION

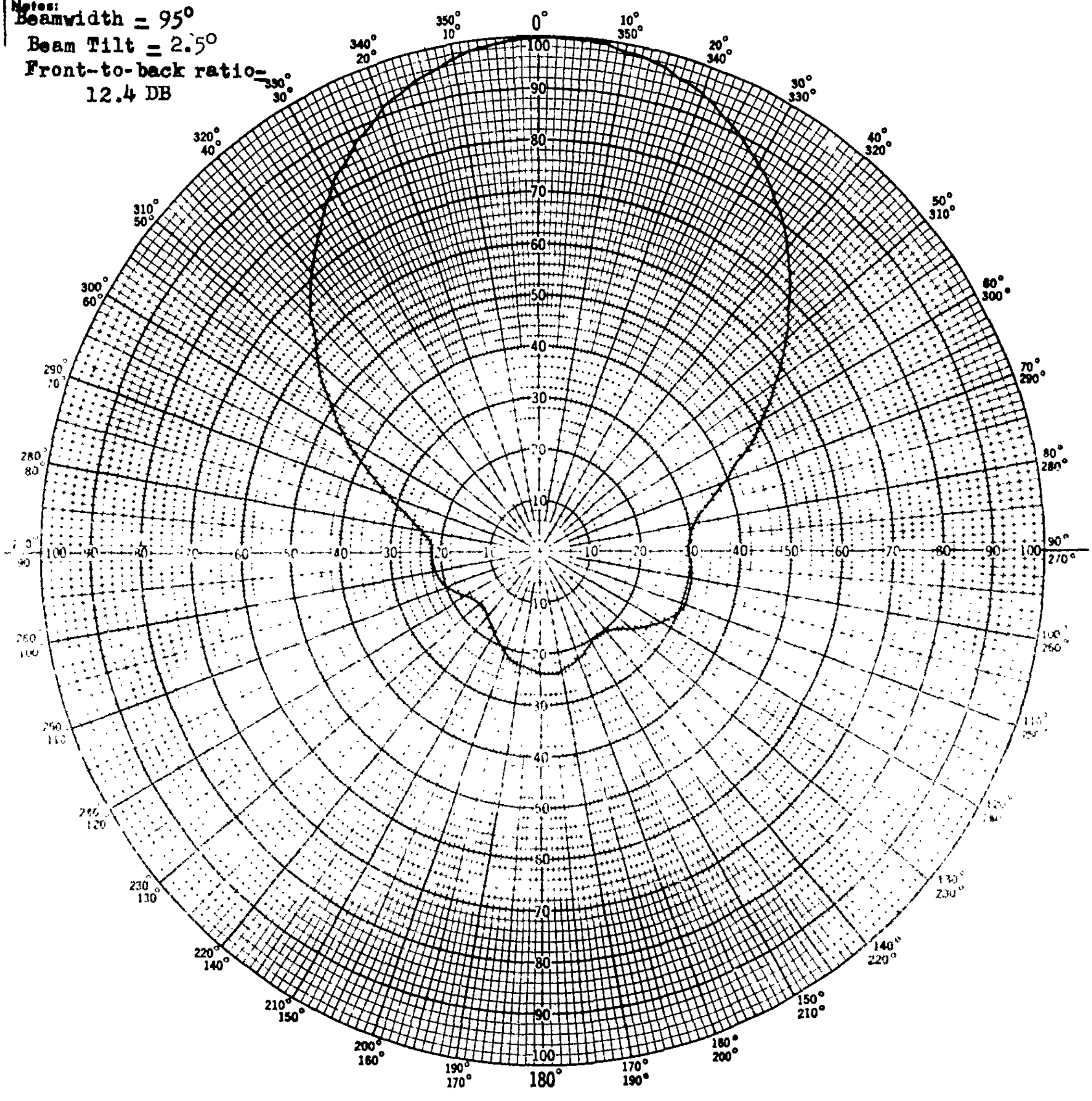
TRANSMITTER: VERTICAL ☒ HORIZONTAL ☐

RECEIVER: VERTICAL ☒ HORIZONTAL ☐

ROTATION: AZIMUTH ☒ ELEVATION ☐

PATTERN: E-PLANE ☐ H-PLANE ☒ AXIAL RATIO ☐

Notes:
Beamwidth = 95°
Beam Tilt = 2.5°
Front-to-back ratio= 12.4 DB



PATTERN NO. 11

POLAR CHART - (LINEAR)

FIGURE 16

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 450 Mc

SCALE: POWER [ ] VOLTAGE [X]

PERSONNEL: Peter Bodnar

POLARIZATION

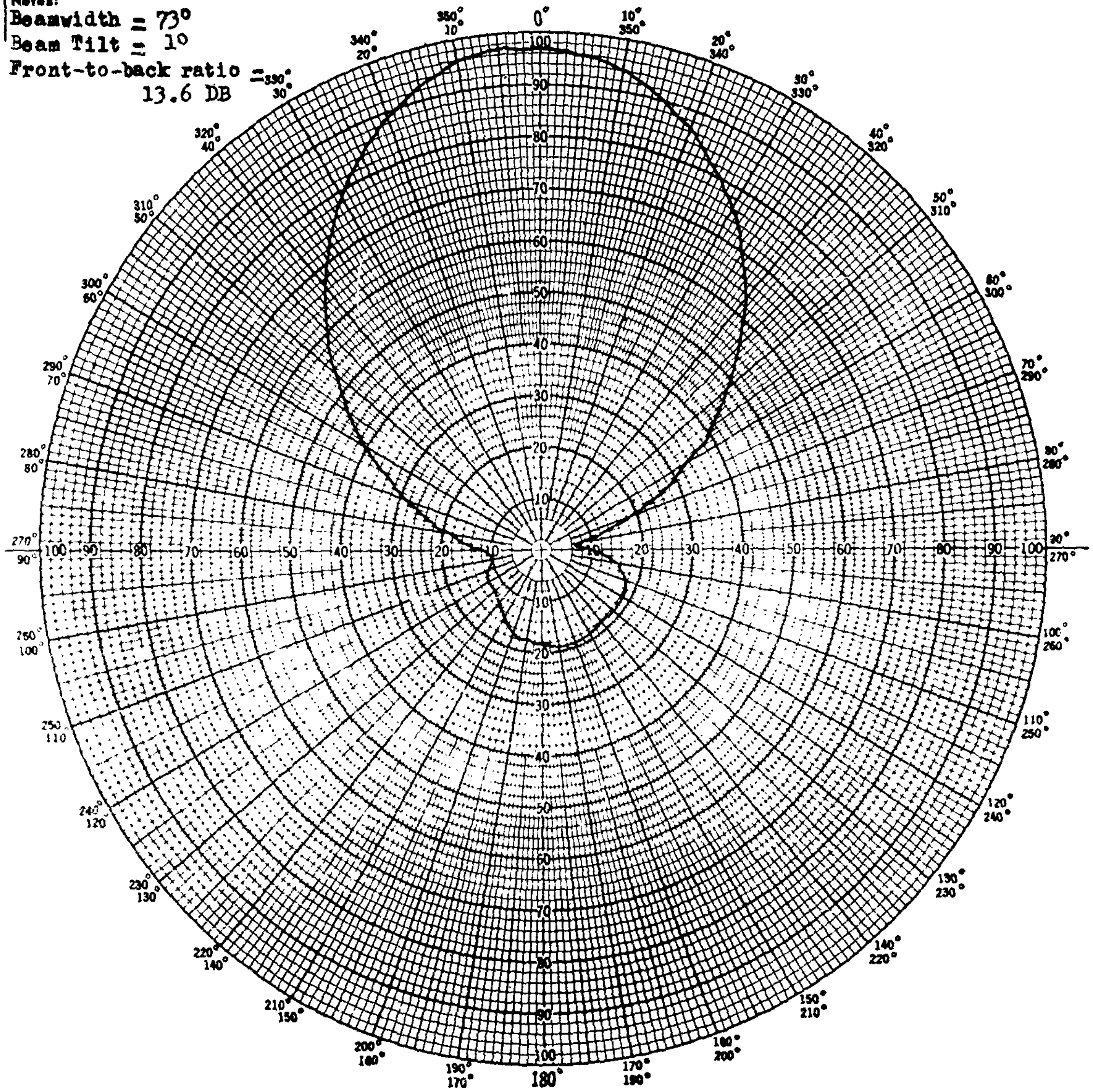
TRANSMITTER		RECEIVER		ROTATION		PATTERN	
VERTICAL	[ ]	VERTICAL	[ ]	AZIMUTH	[X]	E-PLANE	[X]
HORIZONTAL	[X]	HORIZONTAL	[X]	ELEVATION	[ ]	H-PLANE	[ ]
						AXIAL RATIO	[ ]

Notes:

Beamwidth = 73°

Beam Tilt = 1°

Front-to-back ratio = 13.6 DB



PATTERN NO. 12

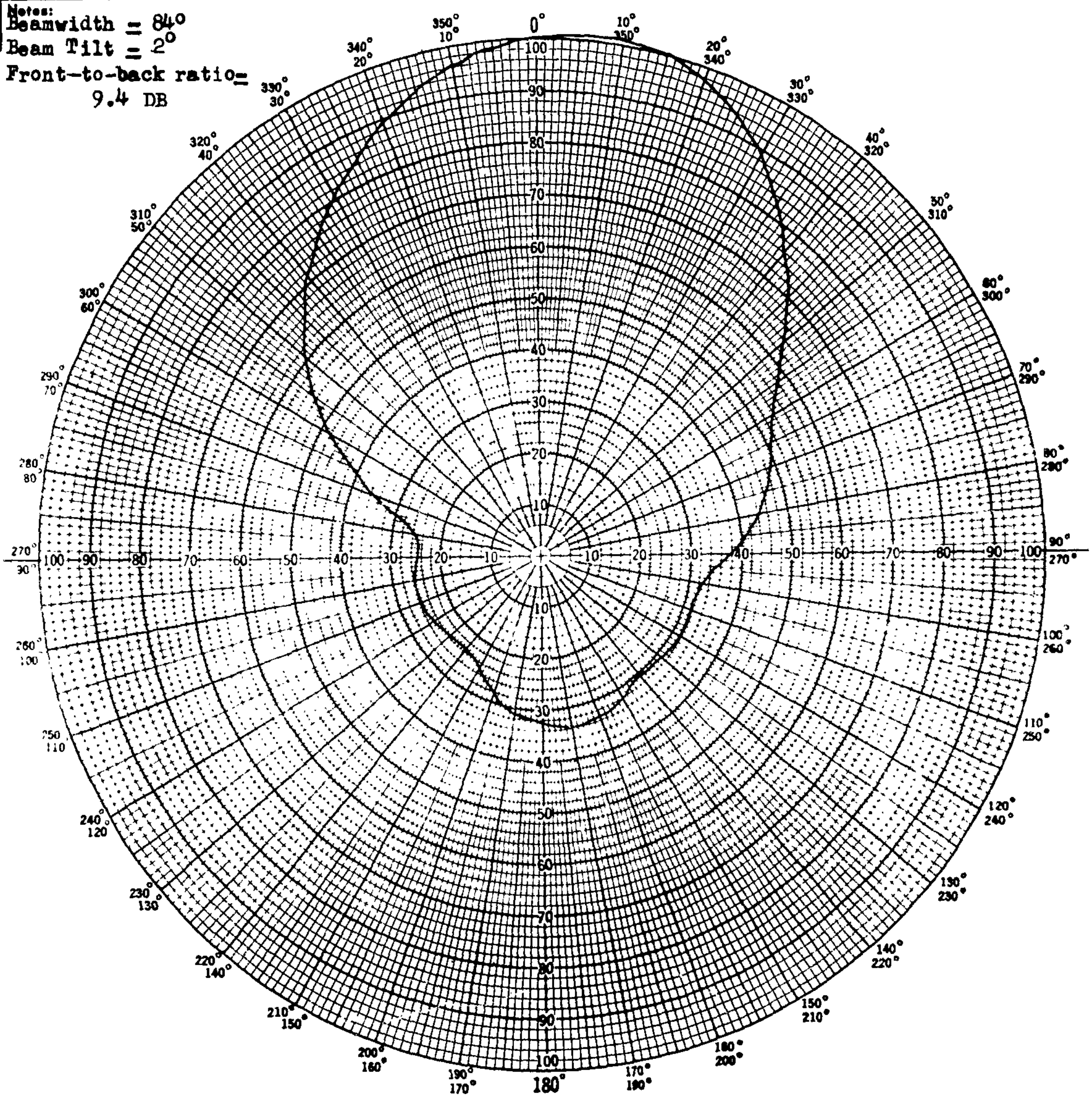
POLAR CHART - (LINEAR)

FIGURE 17

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 500 Mc	POLARIZATION		PATTERN
	TRANSMITTER / RECEIVER	ROTATION	E-PLANE ☐
SCALE: POWER ☐ VOLTAGE ☒	VERTICAL ☒ / VERTICAL ☒	AZIMUTH ☒	H-PLANE ☒
PERSONNEL: Peter Bodnar	HORIZONTAL ☐ / HORIZONTAL ☐	ELEVATION ☐	AXIAL RATIO ☐

Notes:
Beamwidth = 84°
Beam Tilt = 2°
Front-to-back ratio = 9.4 DB



PATTERN NO. 13

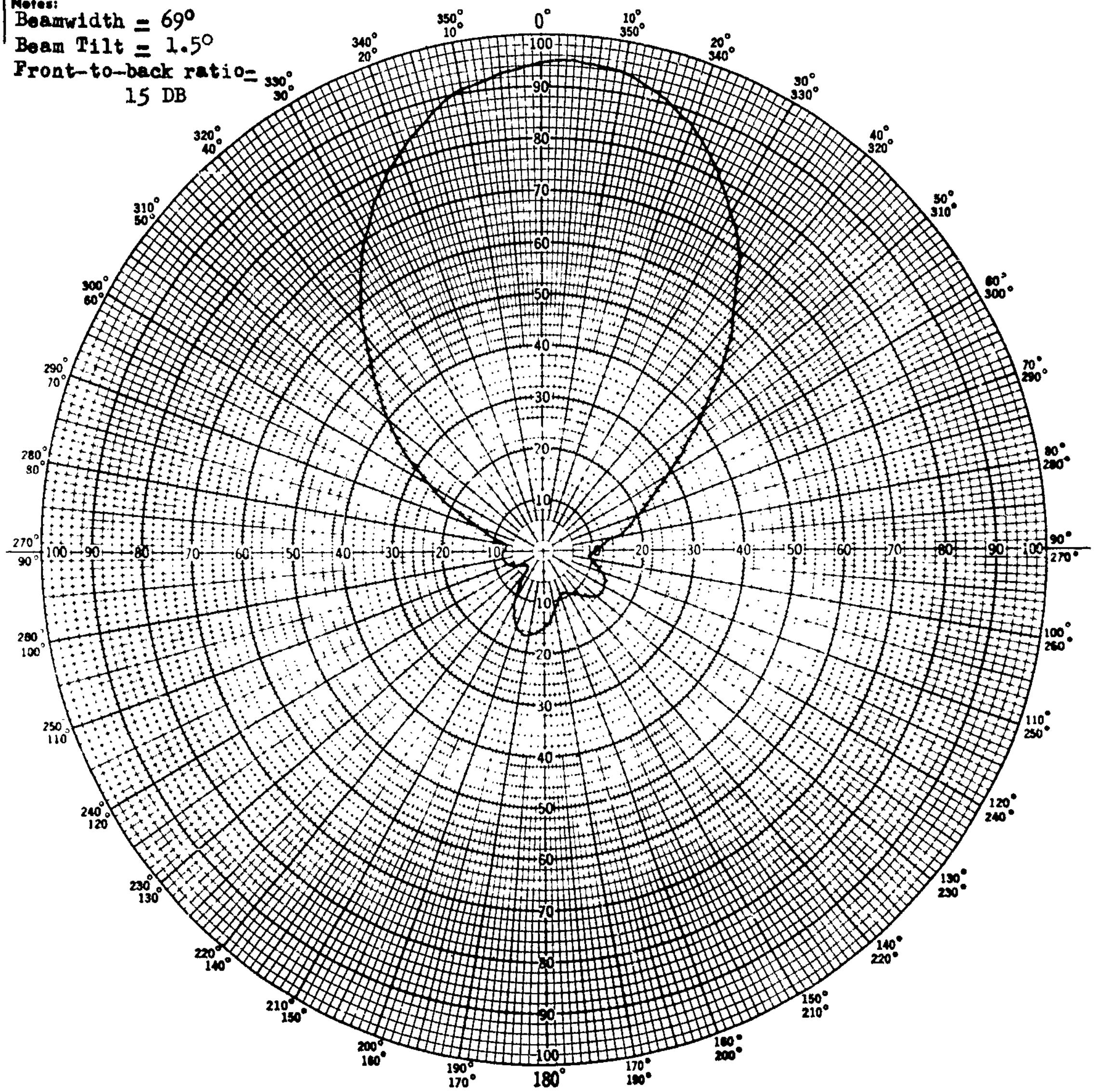
POLAR CHART - (LINEAR)

FIGURE 18

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 500 Mc.	POLARIZATION		PATTERN
	TRANSMITTER	RECEIVER	ROTATION	
SCALE: POWER ☐ VOLTAGE ☒	VERTICAL ☐	VERTICAL ☐	AZIMUTH ☒	E-PLANE ☒
				H-PLANE ☐
PERSONNEL: Peter Bodnar	HORIZONTAL ☒	HORIZONTAL ☒	ELEVATION ☐	AXIAL RATIO ☐

Notes:
Beamwidth = 69°
Beam Tilt = 1.5°
Front-to-back ratio = 15 DB



PATTERN NO. 14

POLAR CHART - (LINEAR)

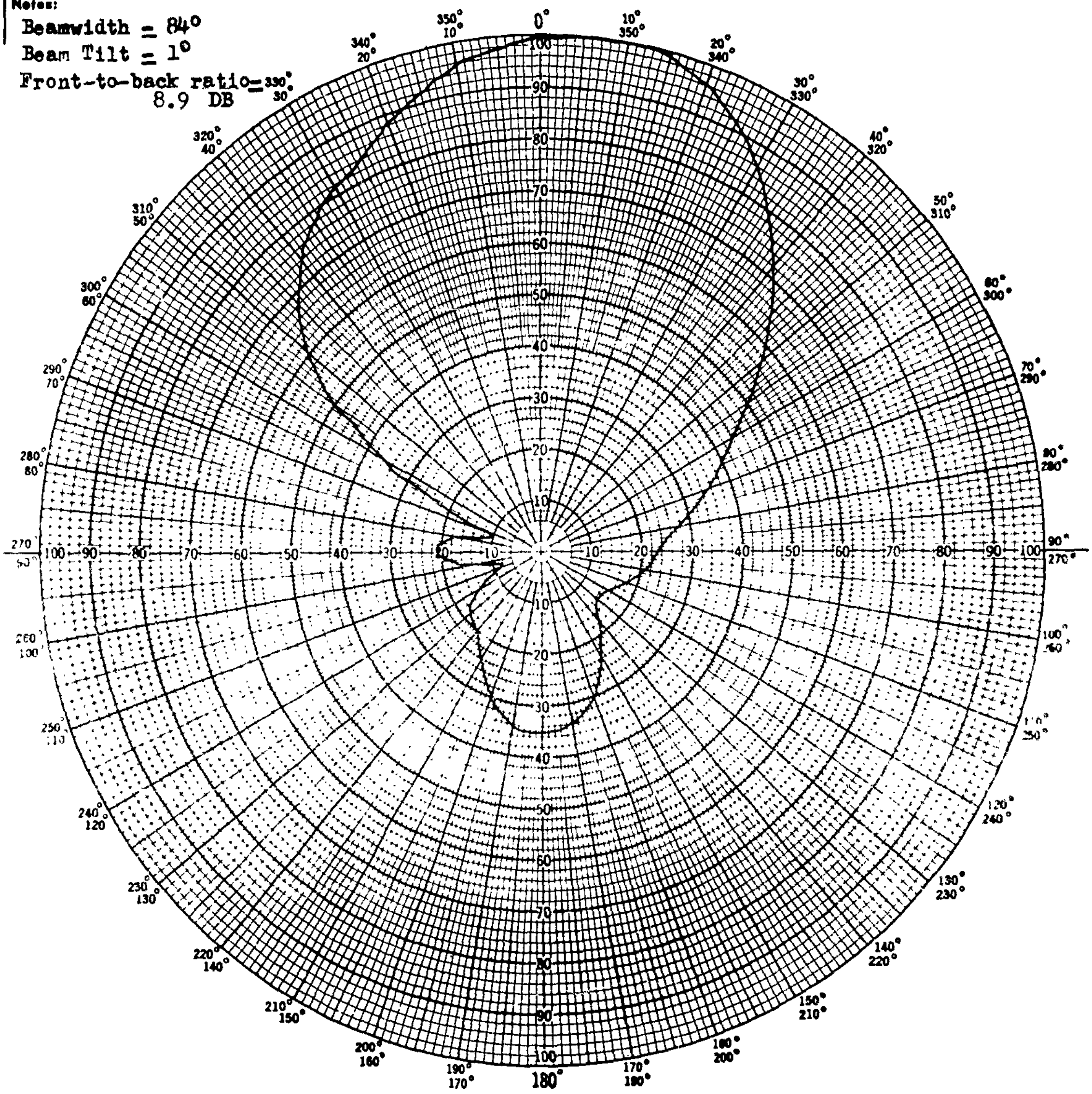
FIGURE 19

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 550 Mc
SCALE: POWER [ ] VOLTAGE [X]
PERSONNEL: Peter Bodnar

POLARIZATION — TRANSMITTER: VERTICAL [X] HORIZONTAL [ ]; RECEIVER: VERTICAL [X] HORIZONTAL [ ]
ROTATION: AZIMUTH [ ] ELEVATION [ ]
PATTERN: E-PLANE [ ] H-PLANE [X] AXIAL RATIO [ ]

Notes:
Beamwidth = 84°
Beam Tilt = 1°
Front-to-back ratio = 8.9 DB



PATTERN NO. 15

POLAR CHART - (LINEAR)

FIGURE 20

FINAL MODEL AS-1089(XE-1)/ML

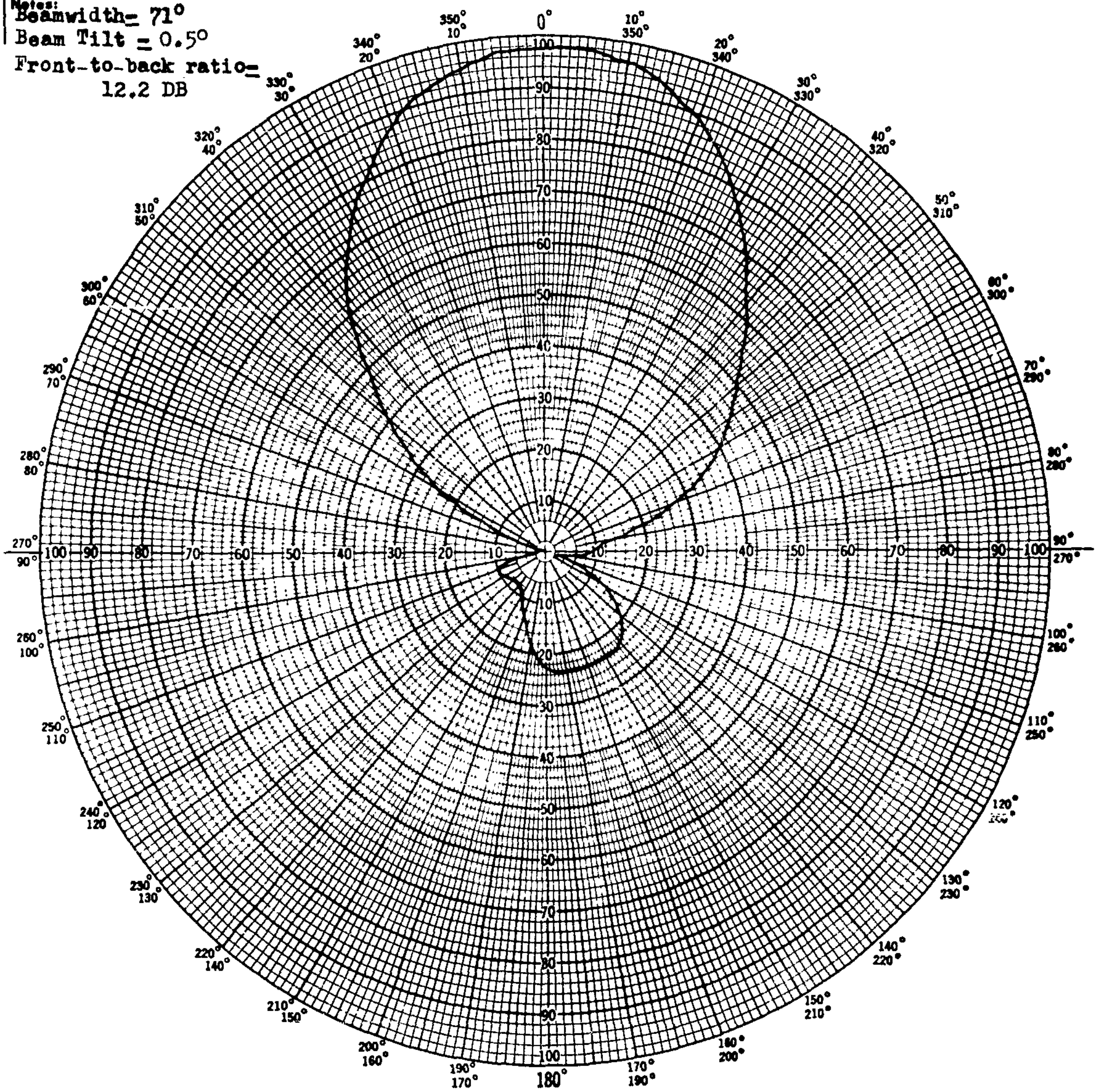
FREQUENCY: 550 Mc.

SCALE: POWER ☐ VOLTAGE ☒

PERSONNEL: Peter Bodnar

POLARIZATION: TRANSMITTER		POLARIZATION: RECEIVER		ROTATION		PATTERN	
VERTICAL	☐	VERTICAL	☐	AZIMUTH	☒	E-PLANE	☒
HORIZONTAL	☒	HORIZONTAL	☒	ELEVATION	☐	H-PLANE	☐
						AXIAL RATIO	☐

Notes:
Beamwidth = 71°
Beam Tilt = 0.5°
Front-to-back ratio = 12.2 DB



PATTERN NO. 16

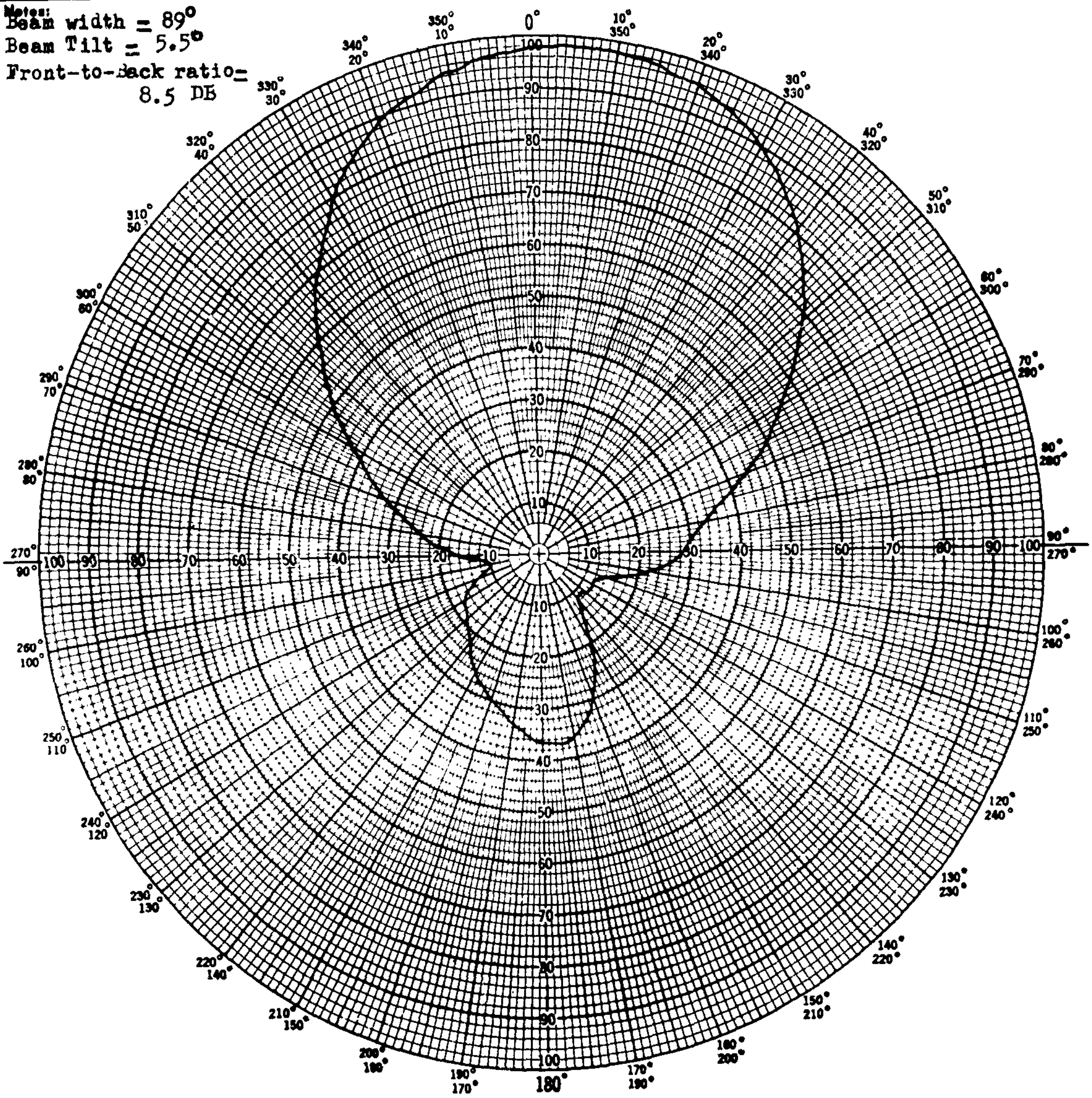
POLAR CHART - (LINEAR)

FIGURE 21

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 600 Mc		**POLARIZATION**			**PATTERN**	
	TRANSMITTER		**RECEIVER**		**ROTATION**	
SCALE: POWER [ ] VOLTAGE [X]	VERTICAL [X]		VERTICAL [X]		AZIMUTH [X]	E-PLANE [ ]
PERSONNEL: Peter Bodnar	HORIZONTAL [ ]		HORIZONTAL [ ]		ELEVATION [ ]	H-PLANE [X]
						AXIAL RATIO [ ]

Notes:
Beam width = 89°
Beam Tilt = 5.5°
Front-to-Back ratio= 8.5 DB



PATTERN NO. 17

POLAR CHART - (LINEAR)

FIGURE 22

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 600 Mc

SCALE: POWER [ ] VOLTAGE [X]

PERSONNEL: eter Bodnar

POLARIZATION

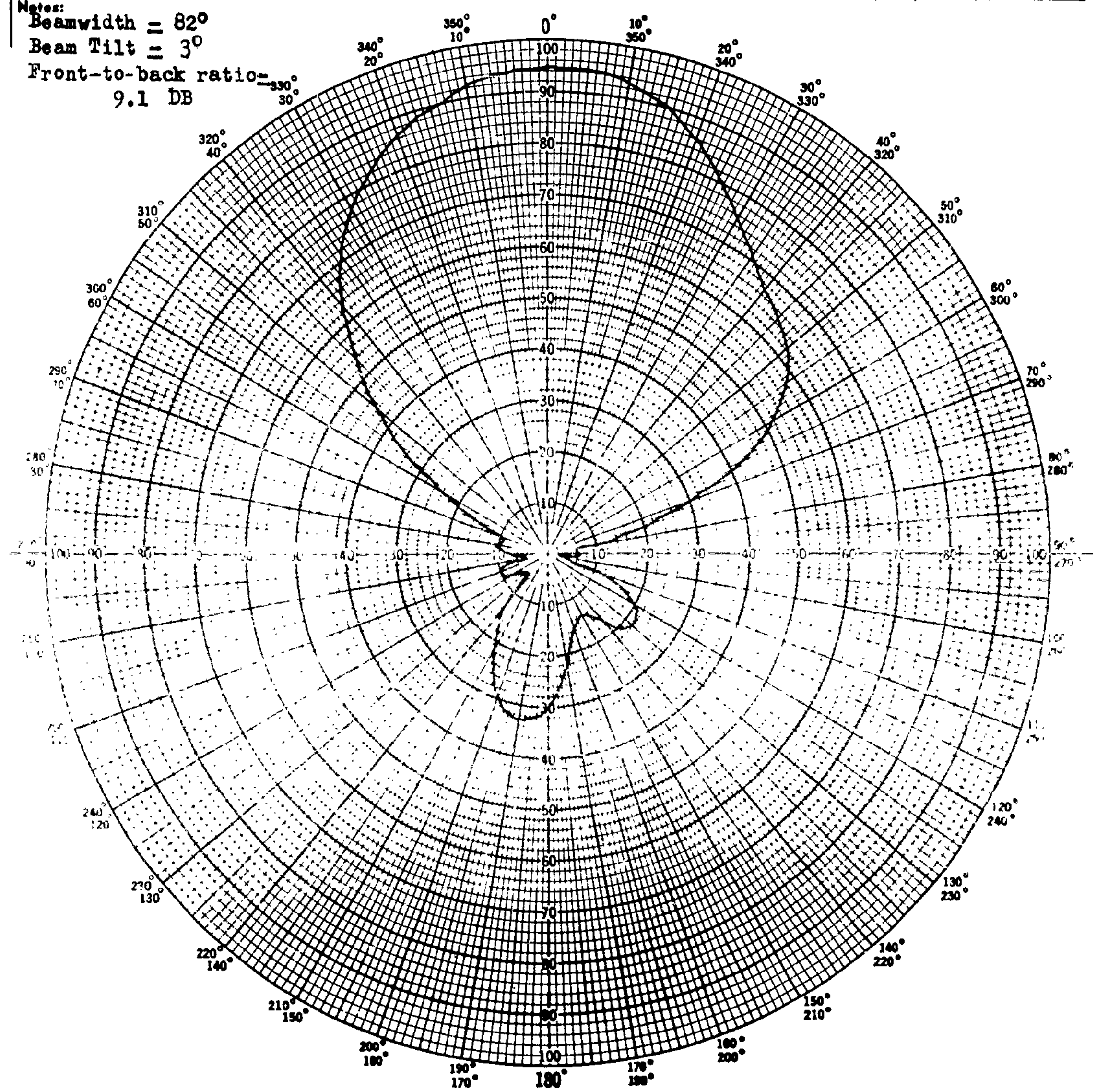
TRANSMITTER: VERTICAL [ ] HORIZONTAL [X]

RECEIVER: VERTICAL [ ] HORIZONTAL [X]

ROTATION: AZIMUTH [X] ELEVATION [ ]

PATTERN: E-PLANE [X] H-PLANE [ ] AXIAL RATIO [ ]

Notes:
Beamwidth = 82°
Beam Tilt = 3°
Front-to-back ratio = 9.1 DB



PATTERN NO. 18

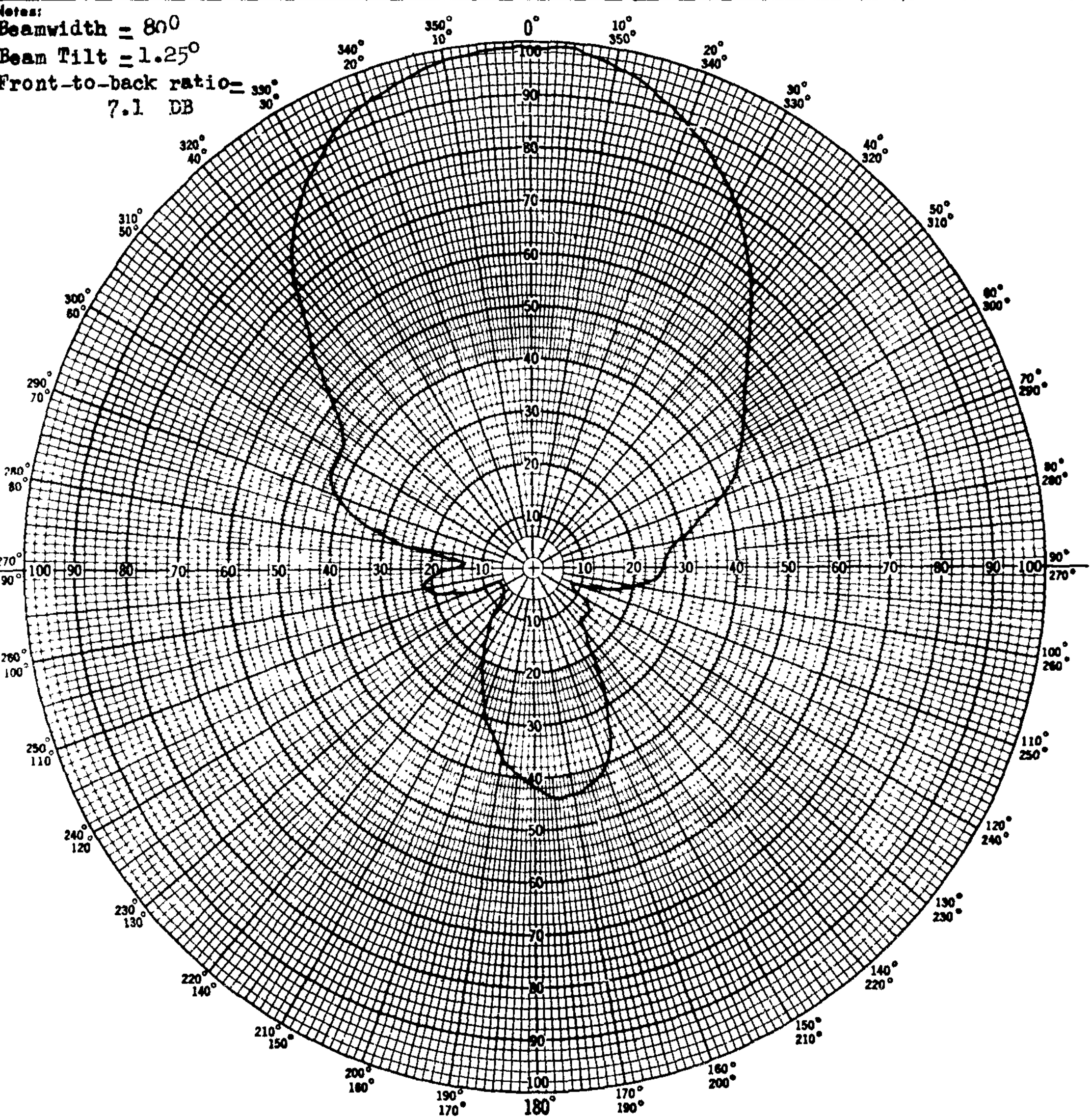
POLAR CHART - (LINEAR)

FIGURE 23

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 660 Mc	**POLARIZATION**			**PATTERN**
	TRANSMITTER	**RECEIVER**	**ROTATION**	E-PLANE ☐
SCALE: POWER ☐ VOLTAGE ☒	VERTICAL ☒	VERTICAL ☒	AZIMUTH ☒	H-PLANE ☒
PERSONNEL: Peter Bodnar	HORIZONTAL ☐	HORIZONTAL ☐	ELEVATION ☐	AXIAL RATIO ☐

Notes:
Beamwidth = 80°
Beam Tilt = 1.25°
Front-to-back ratio = 7.1 DB

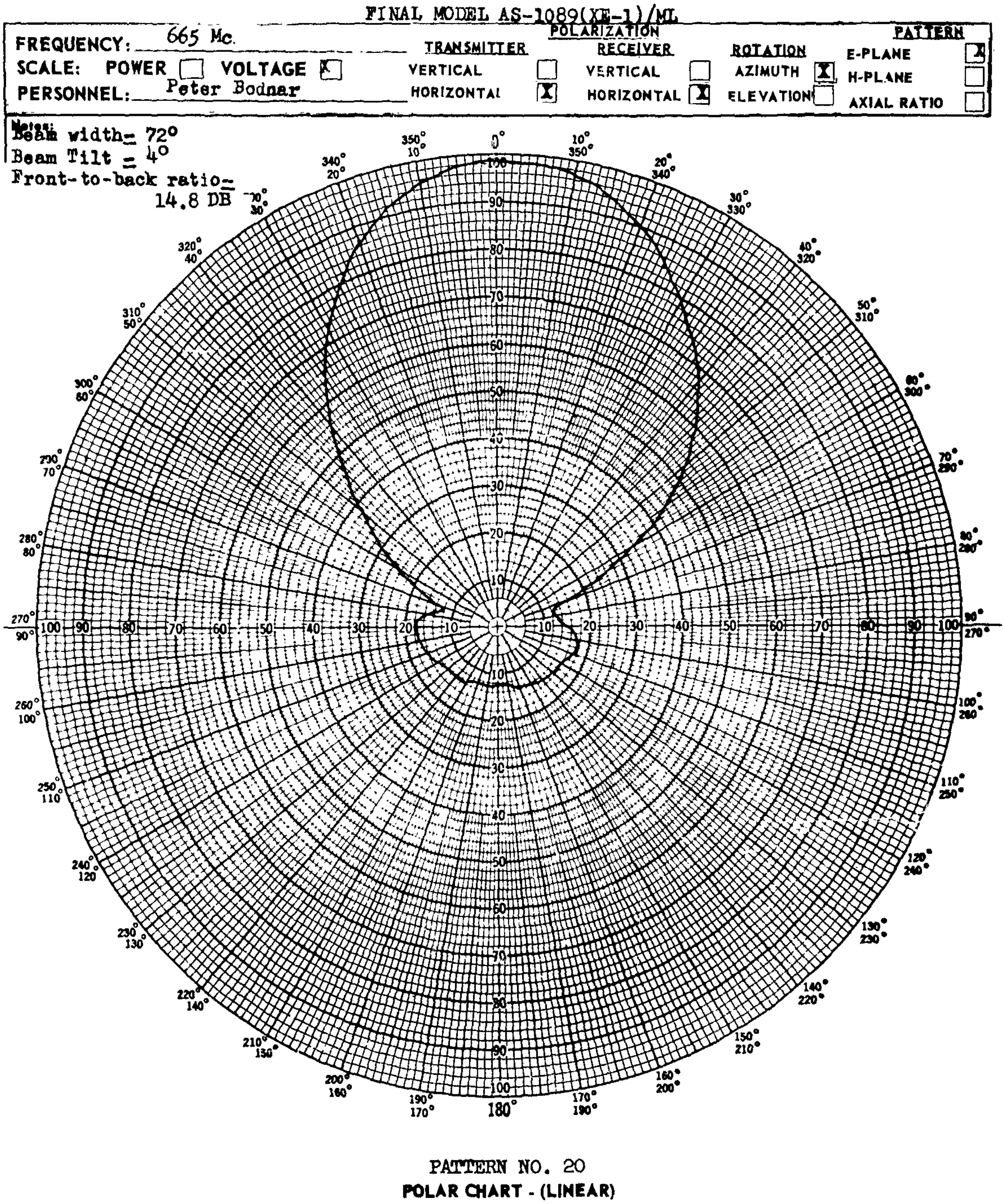


PATTERN NO. 19

POLAR CHART - (LINEAR)

FIGURE 24

FINAL MODEL AS-1089(XE-1)/ML



PATTERN NO. 20

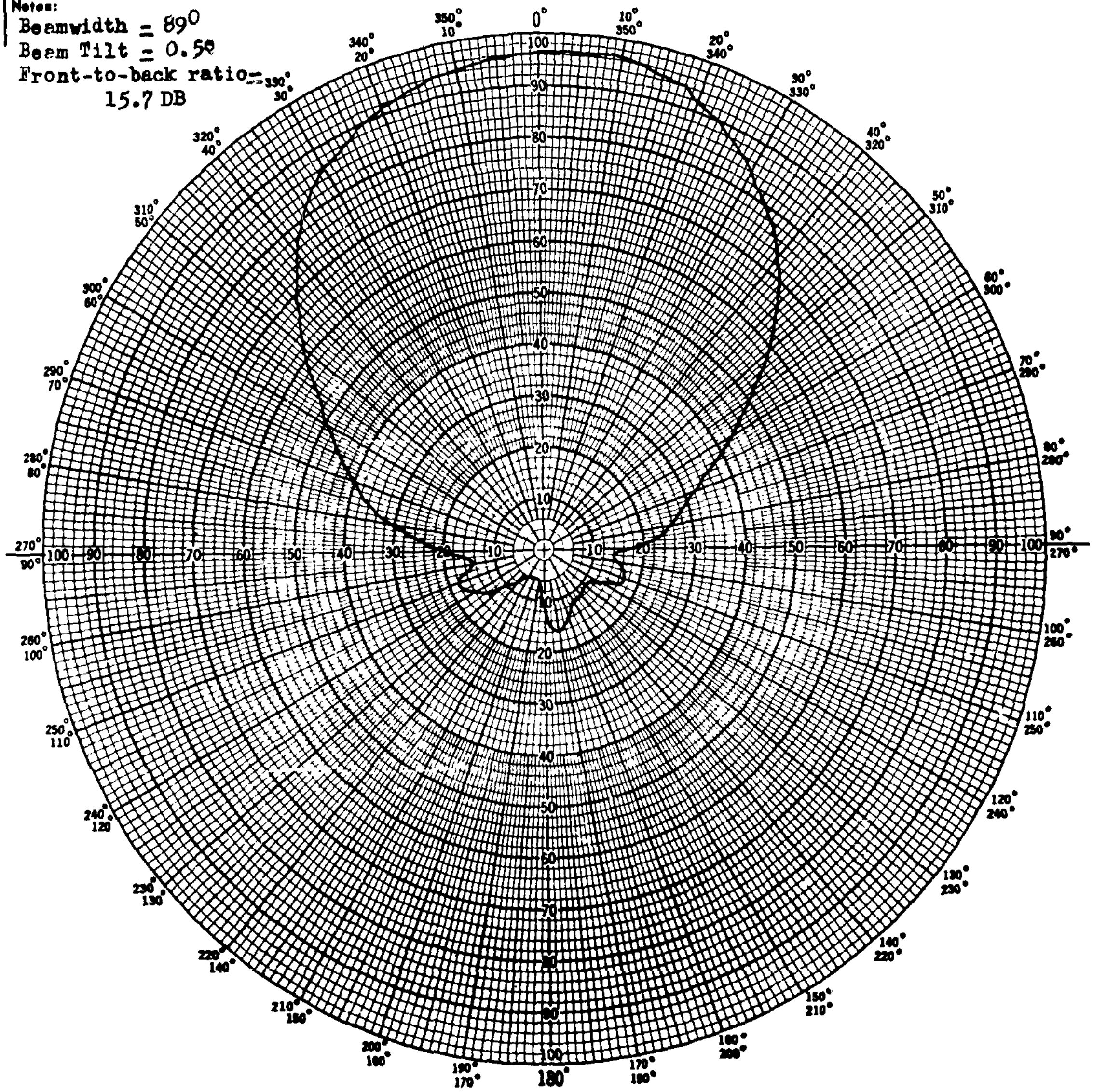
POLAR CHART - (LINEAR)

FIGURE 25

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 700 Mc.	**POLARIZATION**		**PATTERN**
	TRANSMITTER	RECEIVER	ROTATION	
SCALE: POWER [ ] VOLTAGE [X]	VERTICAL [X]	VERTICAL [X]	AZIMUTH [X]	E-PLANE [ ]
PERSONNEL: Peter Bodnar	HORIZONTAL [ ]	HORIZONTAL [ ]	ELEVATION [ ]	H-PLANE [X]
				AXIAL RATIO [ ]

Notes:
Beamwidth = 89°
Beam Tilt = 0.5°
Front-to-back ratio = 15.7 DB



PATTERN NO. 21

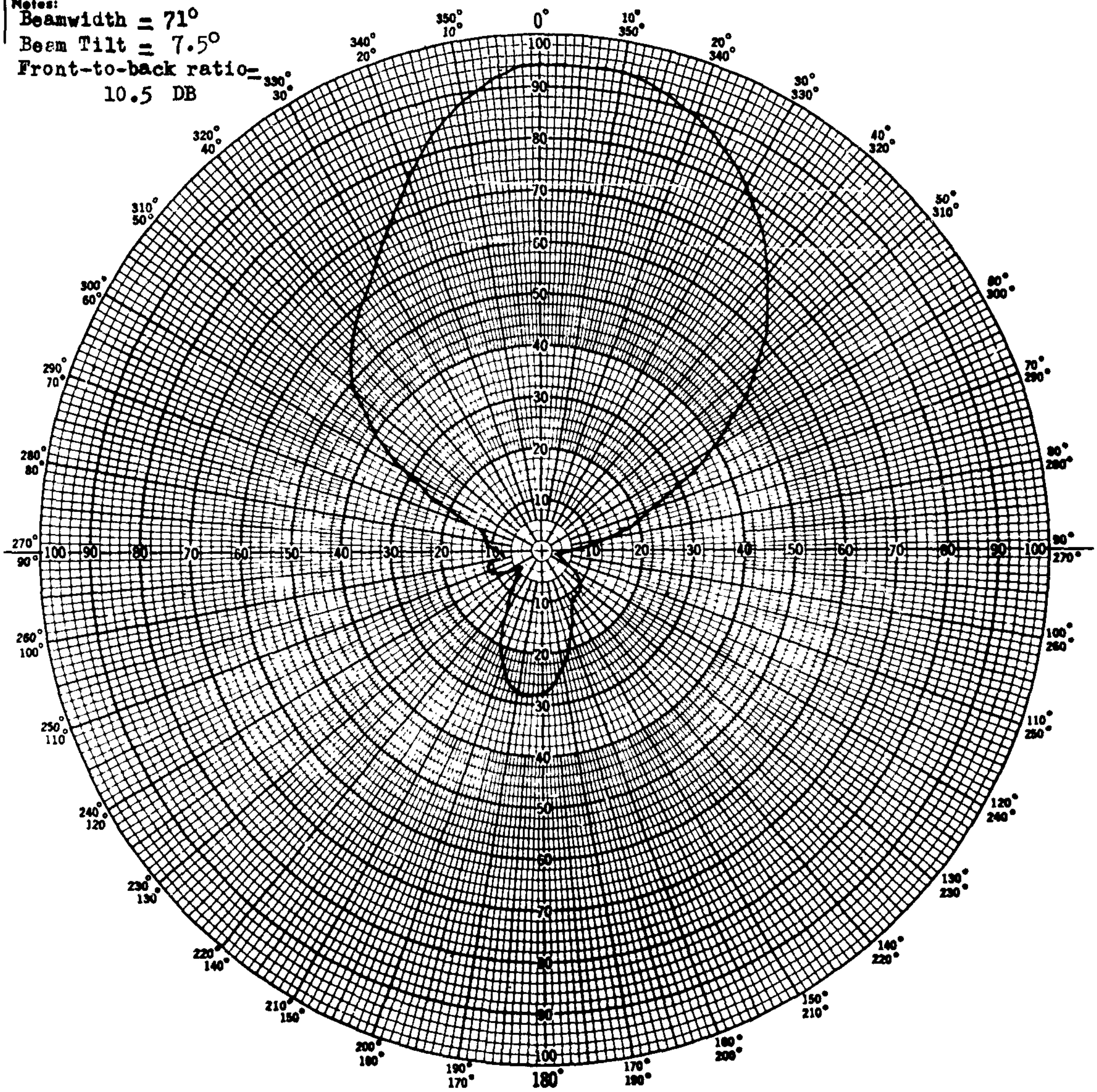
POLAR CHART - (LINEAR)

FIGURE 26

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 700 Mc.	POLARIZATION			PATTERN
	TRANSMITTER	RECEIVER	ROTATION	
SCALE: POWER [ ] VOLTAGE [X]	VERTICAL [ ]	VERTICAL [ ]	AZIMUTH [X]	E-PLANE [X]
PERSONNEL: Peter Bodnar	HORIZONTAL [X]	HORIZONTAL [X]	ELEVATION [ ]	H-PLANE [ ]
				AXIAL RATIO [ ]

Notes:
Beamwidth = 71°
Beam Tilt = 7.5°
Front-to-back ratio= 10.5 DB

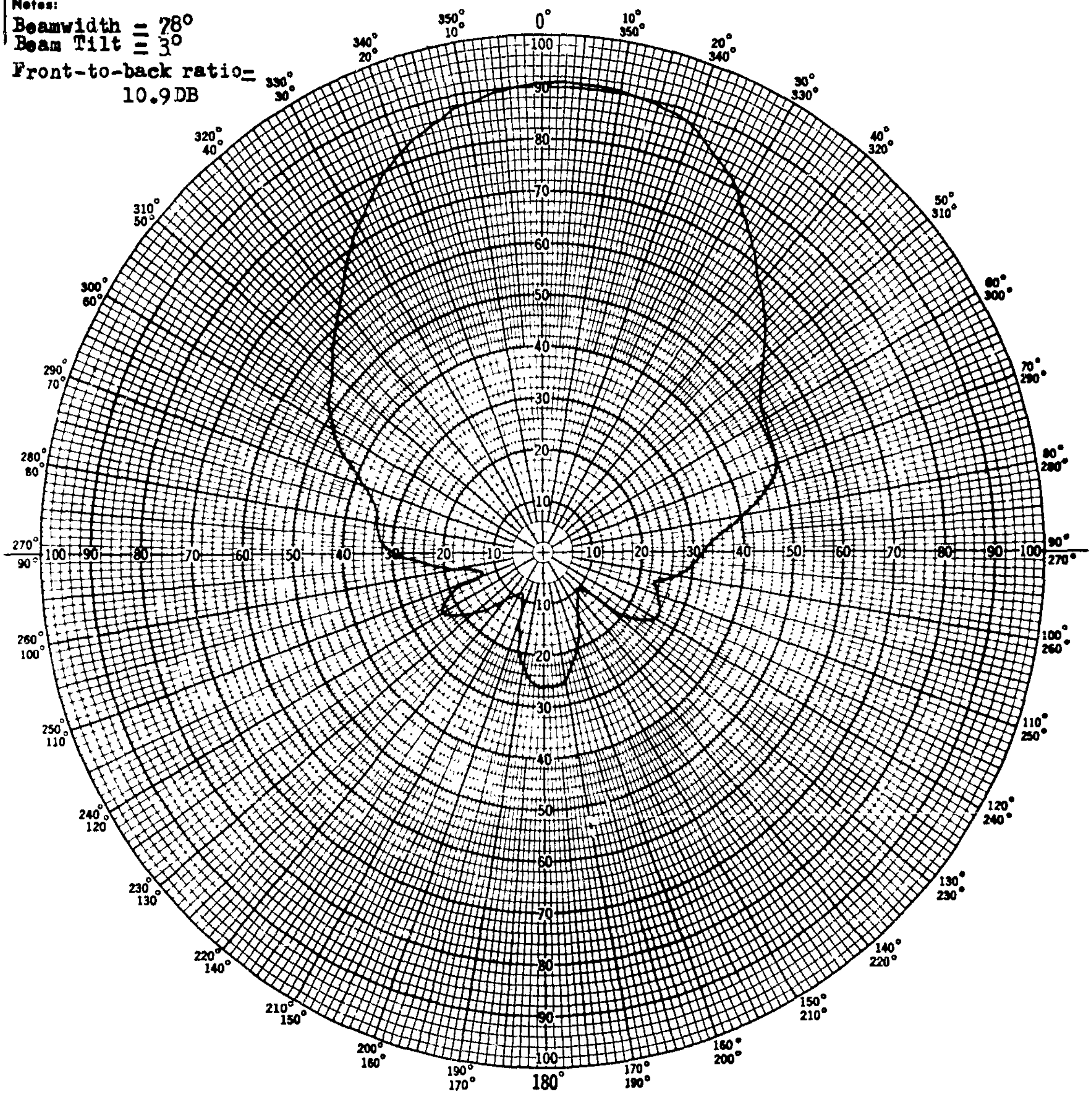


PATTERN NO. 22
POLAR CHART - (LINEAR)
FIGURE 27

FINAL MODEL AS-1089(XE-1)/ML

FREQUENCY: 750 Mc	POLARIZATION TRANSMITTER	POLARIZATION RECEIVER	ROTATION	PATTERN
SCALE: POWER ☐ VOLTAGE ☒	VERTICAL ☒	VERTICAL ☒	AZIMUTH ☒	E-PLANE ☐
PERSONNEL: Peter Bodnar	HORIZONTAL ☐	HORIZONTAL ☐	ELEVATION ☐	H-PLANE ☒
				AXIAL RATIO ☐

Notes:
Beamwidth = 78°
Beam Tilt = 3°
Front-to-back ratio= 10.9 DB



PATTERN NO. 23

POLAR CHART - (LINEAR)

FIGURE 28

FINAL MODEL AS-1089(XE-1)/ML

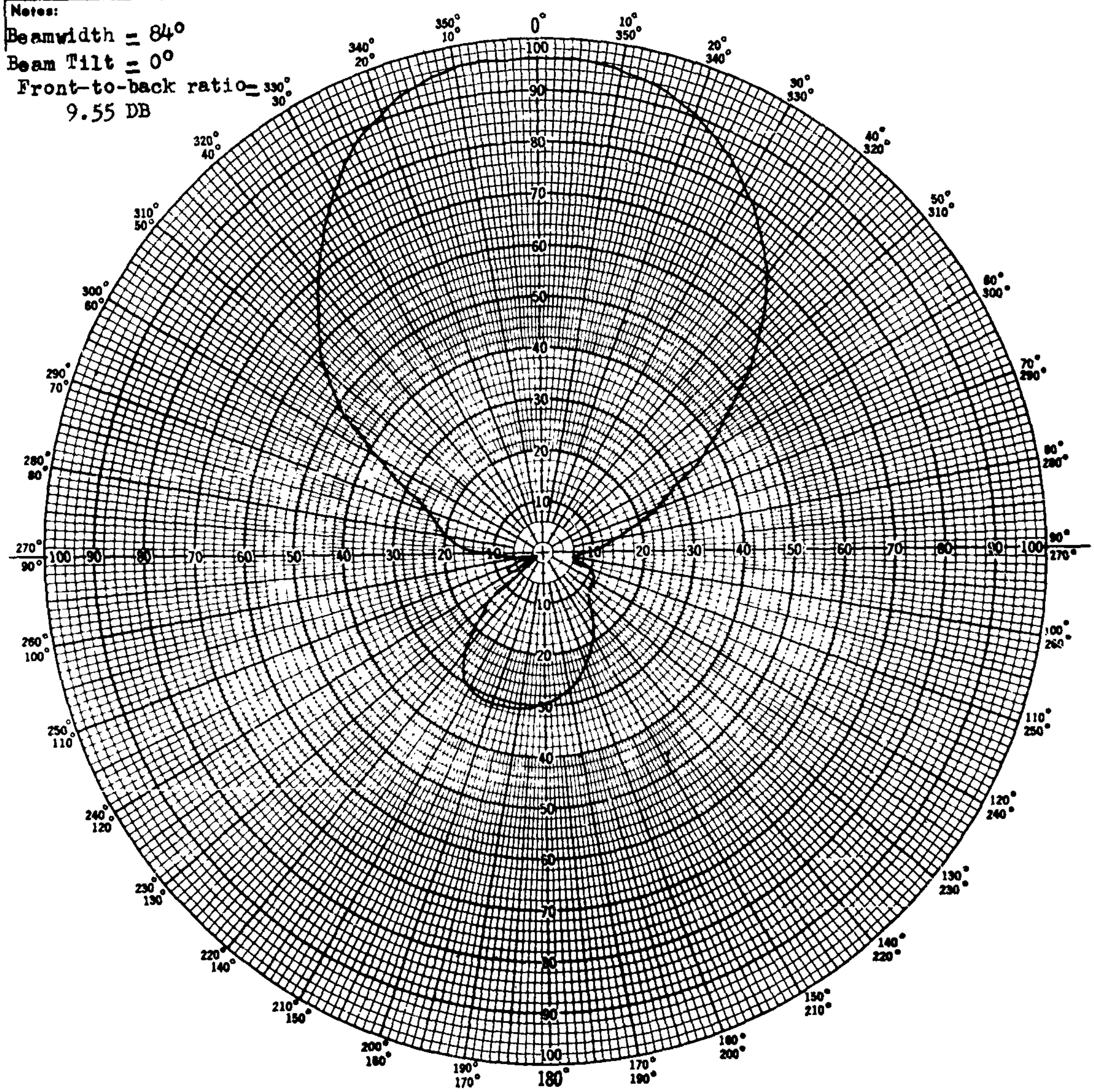
FREQUENCY: 800 Mc		POLARIZATION			ROTATION		PATTERN	
	TRANSMITTER		RECEIVER					
SCALE: POWER [ ] VOLTAGE [X]	VERTICAL	[ ]	VERTICAL	[ ]	AZIMUTH	[X]	E-PLANE	[X]
							H-PLANE	[ ]
PERSONNEL: Peter Bodnar	HORIZONTAL	[X]	HORIZONTAL	[X]	ELEVATION	[ ]	AXIAL RATIO	[ ]

Notes:

Beamwidth = 84°

Beam Tilt = 0°

Front-to-back ratio = 9.55 DB



PATTERN NO. 24

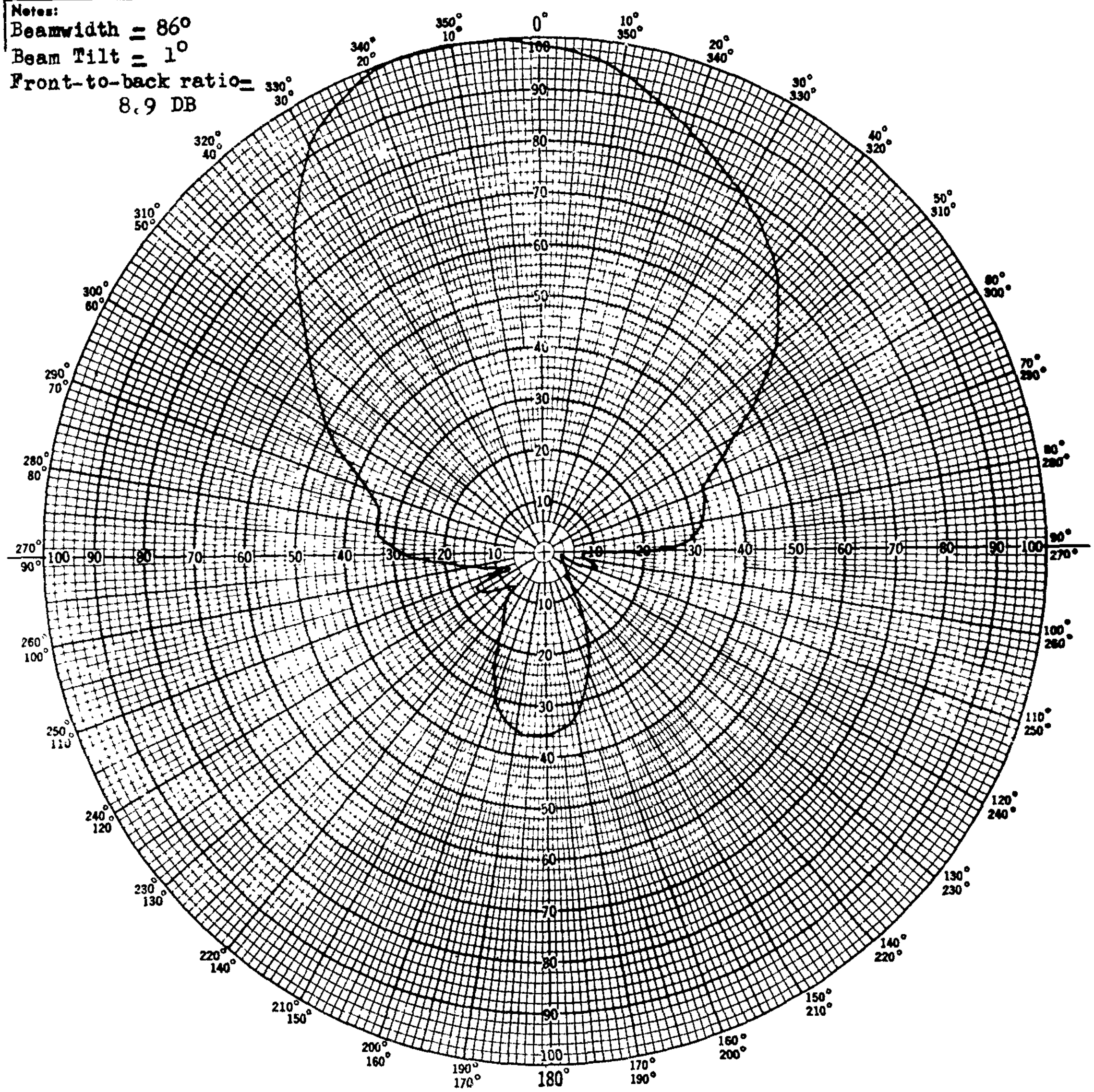
POLAR CHART - (LINEAR)

FIGURE 29

FINAL MODEL AS-1089(XE-1)/ML

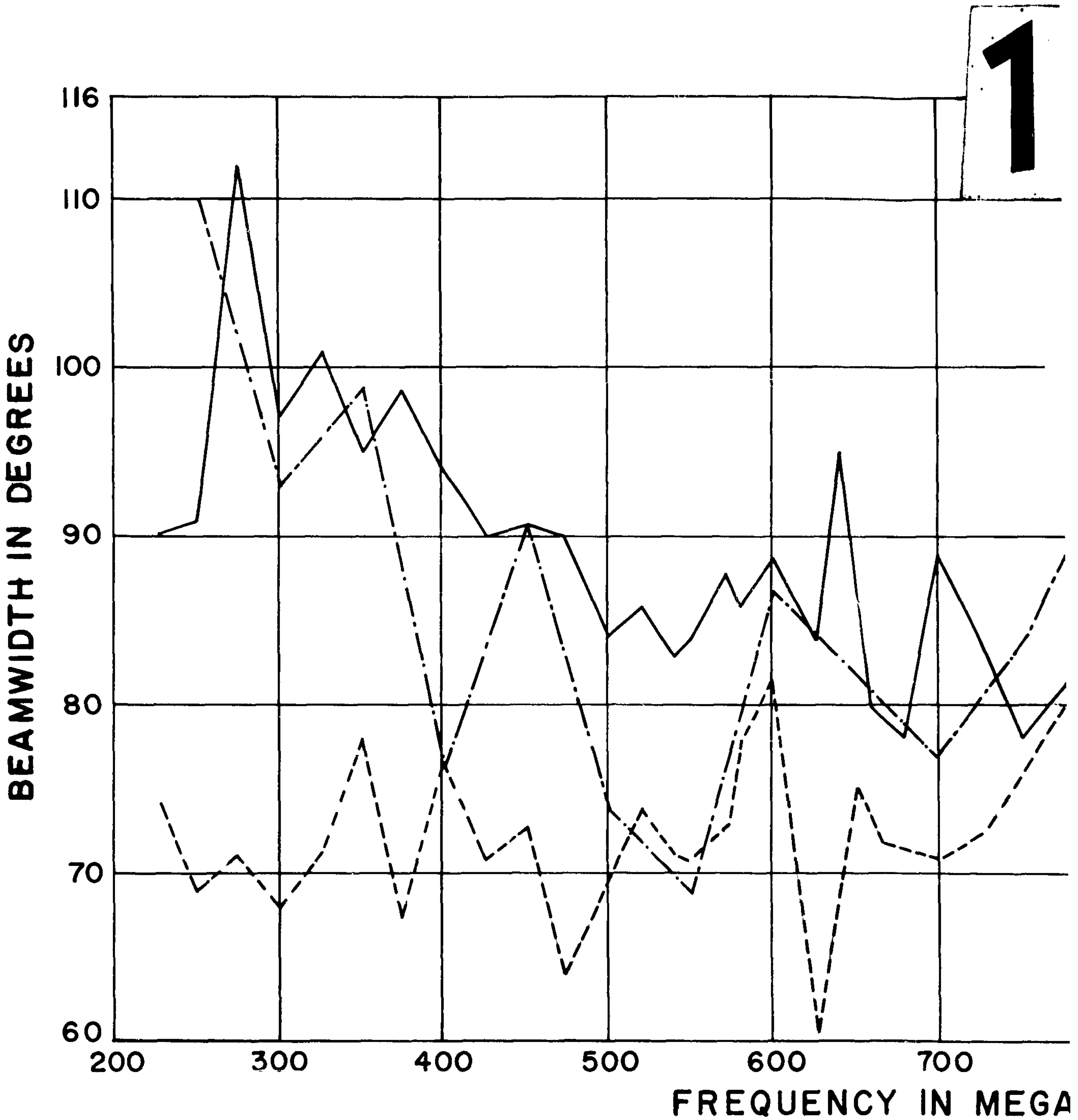
FREQUENCY: 800 Mc	POLARIZATION TRANSMITTER	POLARIZATION RECEIVER	ROTATION	PATTERN
SCALE: POWER [ ] VOLTAGE [X]	VERTICAL [X]	VERTICAL [X]	AZIMUTH [X]	E-PLANE [ ]
PERSONNEL: Peter Bodnar	HORIZONTAL [ ]	HORIZONTAL [ ]	ELEVATION [ ]	H-PLANE [X]
				AXIAL RATIO [ ]

Notes:
Beamwidth = 86°
Beam Tilt = 1°
Front-to-back ratio = 8.9 DB



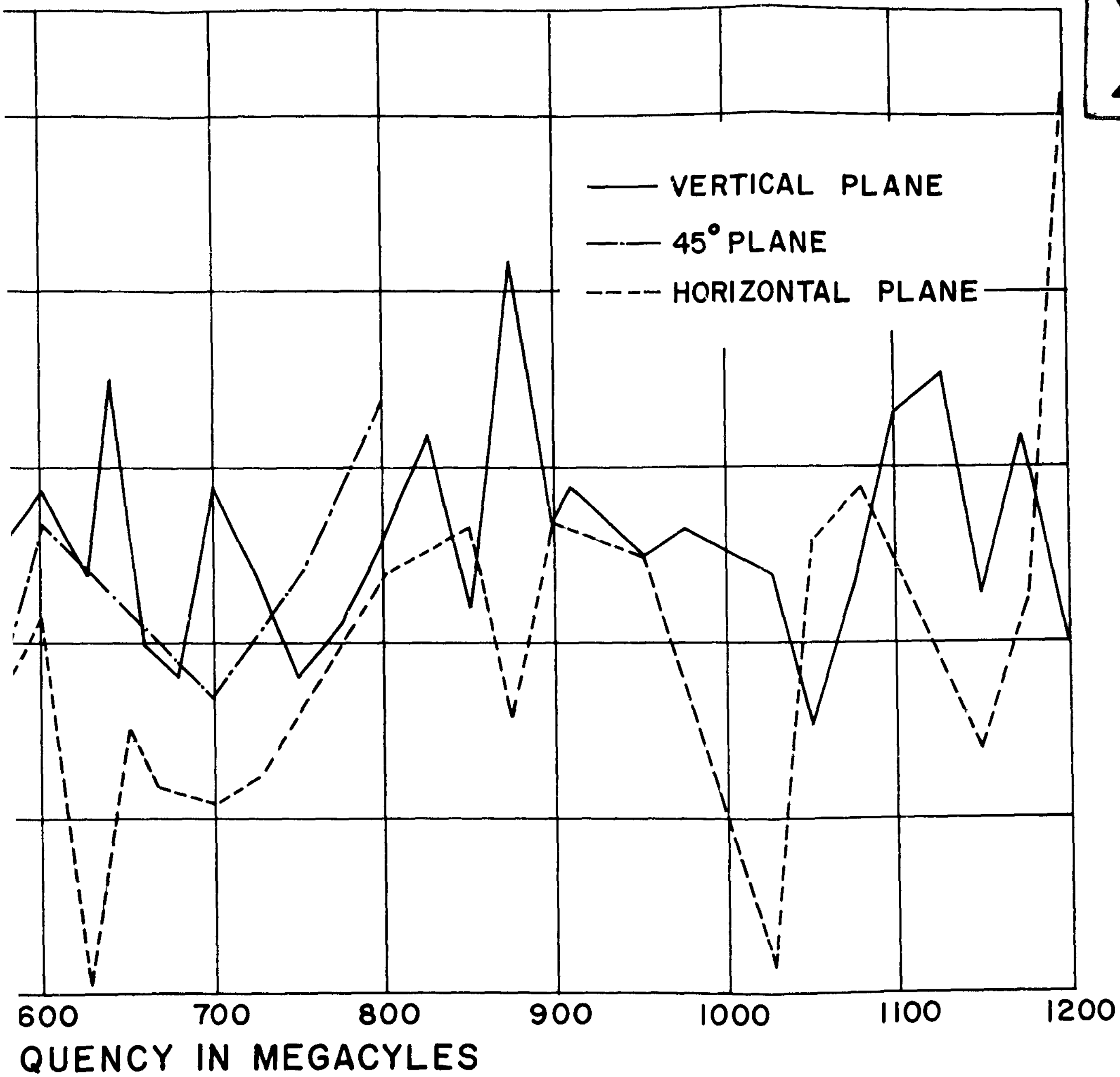
PATTERN NO. 25
POLAR CHART - (LINEAR)

FIGURE 30



HALF-POWER BEAMWIDTH IN 3 PLANES, LOG PI

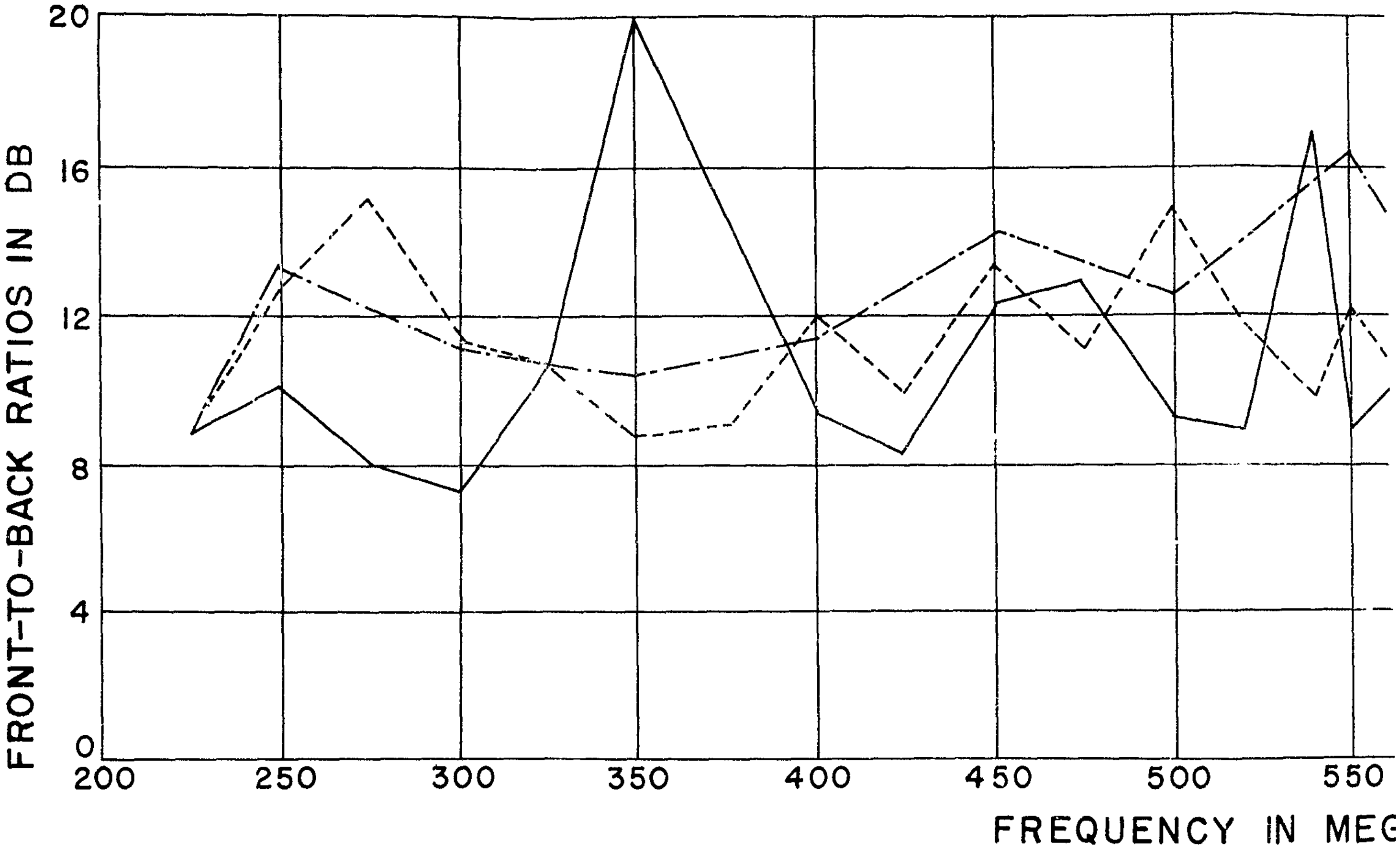
FIG. 31



2

..ANES, LOG PERIODIC ANTENNA AS-1089(XE-1)/ML

FIG. 31



FRONT–TO–BACK RATIOS IN 3 PLANES, LOG PE

FIG. 32

2

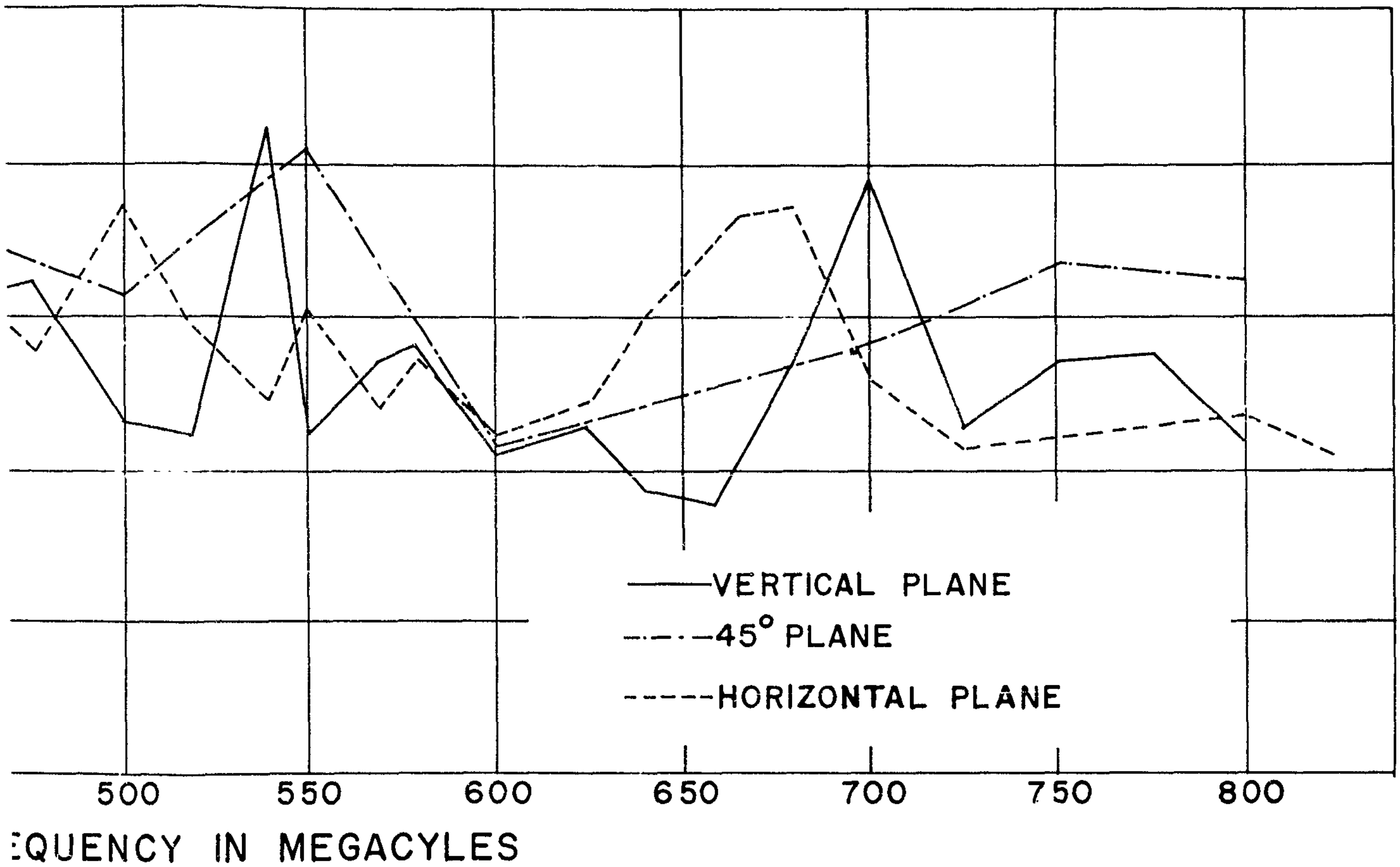


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FIG. 32

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The electrical and mechanical characteristics of Antenna AS-1089(XE-1)/ML, a small, lightweight, broadband antenna of the broadly directional, pyramidal log-periodic type, are described and discussed. The antenna covers the frequency range of 200 to 800 mc, and has moderate gain and a medium power-handling capability. Data on impedance, gain, pattern characteristics, and power-handling capability have been obtained experimentally and are presented in this report. Although designed specifically for transmitting operations in the frequency range of 275 to 600 mc, the antenna can efficiently transmit over the 200- to 800-mc band, and can receive over the 200- to 1200-mc range.

1. Antennas--logarithmic periodic
2. Antennas--transmitting and receiving
3. Direction-finder--200-800 mc
I. Bodnar, Peter
II. Army Electronics Research & Development Laboratory, Fort Monmouth, N. J.
III. DA Task 3E54-01-001-02

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